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THYMUS-STAMMER NUMBER

NEUROGRAPHS

A SERIES OF NEUROLOGICAL
STUDIES, CASES, AND NOTES

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Neurographs

THE ETIOLOGY OF STAMMERING, AND METHODS FOR ITS TREATMENT.

By William Browning, M.D.

I. INTRODUCTION.

In a paper read in 1910 (*N. Y. State J. M.*, 1911, xi, p. 10), the writer stated that "Stammering . . . appears in many cases to be associated at the start with large thymus, if not directly caused thereby." Further experience has not only confirmed this conclusion, but has served to define and extend its scope. It is the purpose of this article to establish more definitely that proposition.

Among the unexplained disorders of humanity, there are now but few as common as stammering. As MacCready says (*J. Am. M. Assn.*, 1910, lv, p. 208): "There has never been a satisfactory explanation of the cause of stammering." It is true that attempts at an explanation are offered, but they fail to satisfy. And it can hardly be said, in the amenable sense, to have been a medical complaint at all.

Stammering is so commonly considered "an inherited weakness of the mechanism of speech," "a developmental neurosis" (Hudson-Makuen), an infective neurosis, an anxiety neurosis (psychosexual, general, etc.) or fright-inhibition, a disturbance of the cerebral or cortical speech-centers, "a transient auditory amnesia" (Bluemel), "a spastic inco-ordinations-neurosis" (Fuld-Romberg, similar to Kussmaul's designation as a spastic co-ordinations-neurosis), ataxia of the speech mechanism, an associative aphasia (Hoepfner), a mental tic, a disturbance of the will, a psychosis, "a diseased state of the mind" (Scrip-

ture), or something intangible and speculative, that it seems crude to offer any simple comprehensible interpretation.

To say that stammering is the result of fear (a phobia), fright, psychic insult, amnesia, auto-suggestion, mental confusion, multiple thought, sexual suppression, lack of confidence, or what not, fails to explain essential features of the disorder. Such things may be in play at times, but do not account for the underlying condition.

Nor is the claim any more satisfactory that, "many, perhaps most, cases find an immediate cause in imitation" (Dessler, 1913), although that may on occasion be the exciting factor.

While these descriptive designations appear to be multitudinous and diverse, they have certain points in common. They largely hinge around the assumption of a central cause, so far as any special site is predicated; although neurosis or ataxia may not necessarily be thus localized. But they all lack definiteness or any logical or detailed justification.

Much skill has been expended in this shuffling of terms. From all of which it is clear, not only that there is no generally accepted or even clear explanation of stammering, but with only less certainty that none of the proffered theories has any comprehensive basis of fact.

Occasional suggestions of possible causes in other directions will be referred to under the respective headings. But the above summary represents apparently the views of the great majority of modern writers on the subject.

Stammering has been much studied, but not the stammerer. This unmedical attitude we may expect to continue towards all conditions where psychic causes or other indefinite "cerebral origin" is accepted as etiologically sufficient.

Practical teachers and elocutionists are more apt than

theoretical students to recognize that the chief disturbance is in the respiratory mechanism far more than in any language center. "In all cases there seems to be a lack of proper respiratory control" (Levine). Even Bluemel calls "respiratory disturbances one of the chief features of physical stammering."

Without making any exhaustive search of the literature, no interpretation has so far been found closely allied to that here offered—no suggestion of a connection with either the endocrine glands in general or the thymus in particular, nor even of a well-marked constitutional condition. Rarely there is a slight approach to it, as in Kalischer's review of Kafeman's work (*vide Neur. Centralbl.*, 1891, p. 98), where adenoids, micro-polyadenopathy (scrofula—Lemcke also is said to have attributed it to a "scrofulous tendency"), and interference with nasal respiration were found to be important factors. Certainly such things, when present, have a close associative relation to the stammer, and serve to aggravate it.

Stammering is not a Brain Trouble.

Numerous facts do not harmonize with the view that this is primarily a brain trouble or of cerebral origin:

a. As a rule these subjects have shown a normally acting speech-system. This speaks against a developmental defect of the structures involved in that function.

"The speech of stammering children is usually normal for a couple of years after commencing to talk" (Lewis and Hynson, 1902, p. 56). "Strictly speaking, it must be regarded as an acquired affection" (Hudson-Makuen.)

b. The condition develops at a certain period of life, and practically never after youth.

"It is rare for the affection to begin after puberty" (Hudson-Makuen).

c. Stammerers may still be able to enunciate correctly

in a singing or often in a whispering voice. A bad stammerer may be "able to recite in unison with others." Lewis and Hynson mention "a man who ordinarily stammers badly, and yet who is a fine public speaker." A stammerer can usually write well enough. "There are few stammerers who cannot swear fluently even when there seems to be no special necessity or provocation for it" (Hudson-Makuen). Exactly the opposite may occur, *i. e.*, a man may only stammer when he gets wrought up enough to swear.

In other words the mechanism centers and function of speech are intact and capable of acting normally.

d. Stammering is frequently recovered from (usually the case in advanced life).

This fact is additional proof that the nervous system is organically intact, and that the character of any disturbance which it may show can at most be but functional and transitory.

e. It is so rarely seen in brain affections, that it has no place in their symptomatology.*

* There have been occasional slight attempts to connect stammering with cerebral symptomatology. But, considering the extent to which both sides have been studied, it is clear that no real connection of this sort has been established. A few citations may suffice:—

For example, the aggravated stuttering after a fall on the head, in Osler's case (*Canada M. and S. J.*, 1878-9, viii, p. 9), admits of so many possibilities as to have no significance here. The same applies to Seletski's case (1908) of stammering after injury to the head.

Pick ("Ueber das sogenannte aphasische Stottern als Symptom verschiedenörtlich localisirter cerebraler Herdaffection," *Arch. f. Psychiat.*, 1899, *vide Jahrbuch*), gives two cases of "peculiar stutter, resp. aphasia." In one, a man of 63 years with right hemiplegia, the speech difficulty was attributed to a spot of softening in the pons. In the other, no examination of the brain-interior was made.

Abadie's "Bégaiement dysarthritique, par lésion limitée de la capsule interne" (1902), apparently refers to a special form of other type.

MacCready (*Penn. M. J.*, 1910, Jan.), gives a case of stuttering associated with congenital word-blindness in a man of 20 years. But it does not appear that this combination is usual; as such cases may recover from the word-blindness, their lesion is undetermined; and though such a case happened to have a brain-focus, the real cause of the stammer might be elsewhere.

Specially instructive is the case of Maas (*Neurol. Centralbl.*, 1913, pp. 72 and 779), where, in a man of 55 years, stuttering persisted for nine years after largely recovering from a left-sided hemiplegia. It was subsequently learned that the man had been more or less of a stammerer previously.

It may be concluded that the dearth and uncertainty of the evidence suffice to discredit the assumption.

As Levine says (*Psychol. Clin.*, 1912, vi, p. 93) of stuttering and stammering:—"These defects do not include disorders of speech associated with brain lesions." Landois (*Physiology*, 1904) expressly separates stammering from "speech derangements of cerebral origin."

It is in fact impracticable to regard it as of cerebral origin and yet never the symptom of any brain condition.

f. It is likewise fallacious to attempt to build up a cerebral theory on the basis of either timidity on the one hand or of hysteria on the other. These conditions are as frequent among females as among males, and in truth are generally recognized as much more so. This cannot be reconciled with the well-known fact that stammering is far more frequent in males than in females.

Timidity, fear and such features are either natural characteristics of the patient, or are fully explained as sequences of the impediment.

g. There is no real confusion of thought, but only in its mechanical expression. Nor is there necessarily any mental impairment. In fact the wit of stammerers is proverbial. And in those stammerers who do show mental defects, the development of the stammer is not accompanied by any special change in mentality.

h. Stammering is unaccompanied by other direct or unequivocal evidence of brain disease. Nor does there appear to be any further proof of central nervous trouble, unless secondarily or as a mere association.

Neurologically these various facts suffice to discredit the cerebral origin of stammering. It is not only unsatisfactory (as many are aware who adopt it for want of something better), but is practically disproven by the lack of evidence.

Though the various lallias, phonias, arthrias and thongias, the repetition habit, "baby talk," or other speech

“trick” may on occasion have a distant resemblance to stammering, they do not appear closely enough related to have any bearing. Nor for that matter is their localization accurately determined.

i. Previous work of many observers, while on the one hand failing to establish any certain evidence that stammering is of cerebral origin, on the other has time and again proven that conditions in and about the upper air-tracts are of great importance in the causation of this trouble—and so far as concerns its organic source that is the sum of all that has been demonstrated. Consequently that is the only region where there is any warrant in hunting for the cause.

That lower centers for the execution of speech may be affected, *e. g.*, in a reflex way, is, of course, possible enough. Nor can any explanation exclude a general influence of the nervous system, such as occurs to some degree in all disorders. In fact it will be shown that the nervous system in these patients is often involved, but in a general sense as part of a systemic condition and not as a specific cause of the stammer.

Associated Conditions.

As is well known in medical matters, attention is too often centered on the immediate manifestations, and too little account taken of the allied and general bearings of the case. And in a disorder so largely handled by non-professionals the wider relations are overlooked.

Careful observation shows, one case with another, a considerable group of interrelated conditions, some known and others here to be described:

These include such things as adenoids, tonsils, nasal intumescence, enuresis nocturna, general hypotonia with bad bodily carriage (winging scapulæ, relaxation of abdomen,

great lumbar in-curve), shallow upper chest, traces of past rachitis, large eating, palpable lymphatic glands, bronchitis, various forms of habit spasm, cardiac leaks and irregularities, certain stigmata; less frequently, epileptiform attacks (Féré even described epileptic stuttering, *v. infra*), mental or moral insufficiency; and constantly, evidence of large thymus or block in that area.

A little rise in the body temperature is common during the early period. And a superadded cold or congestion of the upper air-tracts greatly aggravates the trouble.

“An acute coryza during the course of treatment will cause a severe relapse in a stammerer” (Gutzmann).

It is thus evident that there is an associated or systemic disturbance, strongly suggestive of an abnormality in the developing process. Even Gutzmann (1908) speaks of, “the general disturbances almost invariably present, which primarily appear as nervous phenomena” and require “constitutional treatment.”

Hence stammering is not primarily a disease or independent disorder, but only a symptom; for which there is invariably a basis, and this we should seek. Possibly in inveterate cases the cause may subside, leaving the speech trouble to continue as a habit or relic—though such cases have not been met with. But at the start it should never be considered a separate entity.

For the purposes of the present paper it is not necessary to enter to any extent into the mechanics of the affection. So far as we are now concerned, much of what has apparently been worked out on this side may be correct enough. A goodly share of what has been written hereon, though nominally referring to the cause, really relates to the modus and mechanics of stammering and not strictly speaking to its etiology.

As it is several years since this correlation between

stammering and certain less recognized accompaniments was first noticed, there is some warrant for feeling that the conclusions are not hasty. While the number of cases given may not be great, compared to the opportunities of special clinics, they are ample for intensive study.

These cases include all ages (2 to 65 years) and a wide range as to type, severity, race, and condition. By limiting observations to some single class, there might be greater uniformity in conclusions, but with a corresponding narrowing in applicability. For present purposes it seemed well to include an entirely natural variety (hospital, dispensary and private cases).

A summary of the findings in 25 cases of stammering will next be given.* As they were consecutive observations, they constitute a fair basis for comparison and conclusions.

II. CASES.

Case 1.—Boy, 12 years. April, 1909. Swedish race. Oldest of three living children; one older died from an accident.

Had measles. Pneumonia at 5 years. Pasteur treatment at 5½.

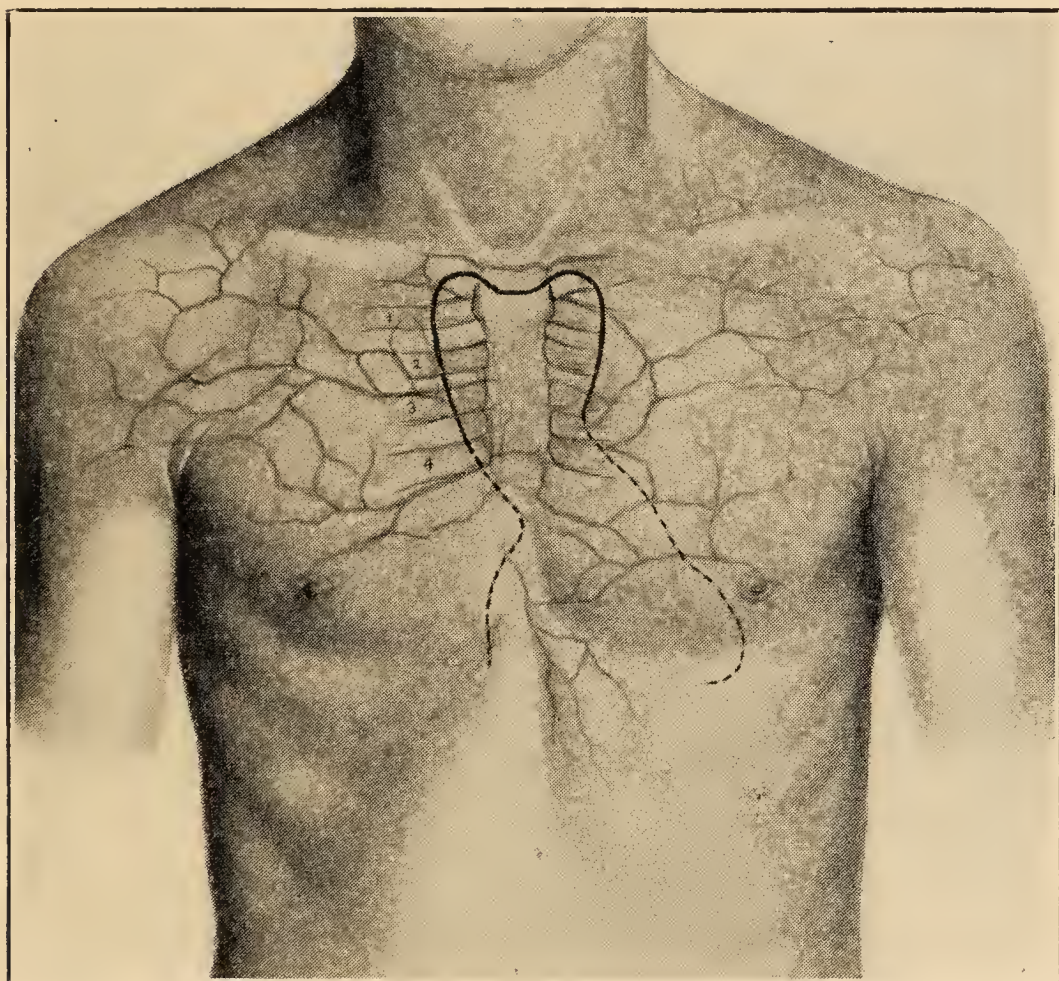
For a year now an increasing trouble with speech, a short stammer. At times is unable to speak and makes grimaces and twisting efforts to do so; again he talks freely. "He's nervous." Is in the fifth grammar grade.

Sleeps fairly 10 hours. Talks in sleep almost nightly. Did wet bed some in younger years. May waken tired.

Is a good eater. Tongue clean. Pain in stomach "about twice a week." Wt. 69 lbs. Ht. 4 ft. 7½ ins. Slight,

* For opportunity to examine a number of these cases (Nos. 7, 11, 15, 16, 24, 25), I am specially indebted to my associate, Dr. R. O. Brockway, Chief of Staff in the Neurological Department at the Polhemus Memorial Clinic.

spare physique. Apparently erect. But scapulæ wing markedly. Much irregular jerking and twitching about hands and body. Little fingers have a wide curve (mongol). Protuberant belly. Ears wing; bobbed lobules.



CASE 1.

Pale. Skin very soft; freckles readily. Skin of hands dry and a trifle scaly. May perspire in play.

Many large flat cervical glands. Bridge of nose depressed. Both nostrils narrow. Tonsils not large. Some torus palatinus. Thyroid seems scanty. Splenic dulness 14 cm. long.

P. 72-64-80, with many little half-drops. Systolic, 96 (mercury column). First sound at apex blurred. Second

a. and p. slightly accentuated. Area of cardiac dulness not enlarged. Hemoglobin, 100 per cent.

Thymus dulness 5 cm. across at top; not palpable at sternal notch. Dilated subcutaneous veins about whole upper front chest region, laterally out to the shoulders, and downward from the thymus, but not on abdomen.

Maximum circumference of head 52, 0 (hair short). C. I. (*i. e.*, cephalic index), 83, 1.

An intercurrent dysentery that May; speech after that again much worse so that at times he could not talk at all; thymic dulness increased to 6.5 cm. across.

(The illustration, used in 1910 and also by Sajous, in the *New York Medical Journal*, was from this case, with a slightly fancy finish by the artist but essentially correct.)

Case 2.—Boy of 10 years. January, 1910, per Dr. L. G. Langstaff. Parents English. Is the sixth of seven children, "none of them like him." Two oldest dead; one at two weeks, and one of diphtheria at 15 years. Possible blow on vertex five years ago, but no mark.

Has always stammered some, at times badly, and again he talks fairly; worse toward night.

Some mental defect noticed now four years. "He doesn't get along at school." Is not a complainer. Is both good-natured and at the same time irritable; angers quickly. Always wants to be on the go. Frontal headache "once a month" or so.

Sleeps mostly on the back; very restless. Still wets the bed almost nightly. Formerly slept with mouth open; and mouth is still dry in the morning.

Dark complexion. Pleasant face. Inclines to be pale. Fair size. Ht. 4 ft. 5¾ ins. Wt. 69 lbs. "He always wants to be drinking."

P. 100. Systolic, 114. Hemoglobin, 93 per cent. No murmur; yet the heart action is somewhat tumultuous, and

the mitrals are not clear. Some accentuation of second a. and p. Oral T. 99, 9.

Enlarged area of thymic dulness, narrowing some upward. Manubrium slightly full. Some veins across upper front chest. Splenic dulness 9 cm. long.

Scapulæ wing somewhat. Excessive tremor of hands. Great nail-biter. Formerly erect, but has developed a great stoop.

Max. head 52, 5 (short stout hair). C. I. 76, 6. Tongue whitish. Teeth normal. High-domed palate. Active bilateral jaw jerk. Throat sensitive. Tonsils and adenoids removed eighteen months ago. Nostrils not closed. Large flat cervical glands. Isthmus and lobes of thyroid soft and seem scanty.

Case 3.—Boy of 10 $\frac{1}{3}$ years. February, 1911, for Dr. C. R. Love. Irish descent. One younger brother. There have also been two miscarriages.

As a child considered large for his age. Circumcised at $2\frac{1}{2}$ years. Called a bright baby. But hardly said a word until 3 years old. Began stammering at $6\frac{1}{2}$ years, combined with other speech peculiarities. His present condition is dated from that period—perhaps only more definitely realized, as at that time he tried kindergarten but, "He simply wouldn't stay." Worn glasses ever since.

Measles at 7 years; several weeks in bed; "he couldn't stand on his feet"; was tender all over, had nose-bleeds, and his hair came out. "Like a baby" on recovering, and had to "start in again."

Memory called good. But he has advanced only two classes. "Tongue is never still." "He's very backward in talking; there are several words he can't say." Says "Oi-oibing" for Irving. The stammer is thus mixed in with other imperfection of speech.

Sleeps 10 hours; very restless, and a sleep talker. Enuresis nightly. Wakens fresh.

"He eats more than I do," says mother. Wt. 90 lbs. Ht. 4 ft. 8 $\frac{3}{4}$ ins. "The least thing tires him," but, "he never feels cold."

A good looking boy, laughs and acts naturally.

Slight, fine tremor. Little fingers kip in. Is a nail biter. Arms show radical and slight ulnar and olecranon jerks. "He stands so round-shouldered."

P. 70. First mitral blurred, not quite definitely a bruit. Accentuated second a. and more p. Systolic low. Hemoglobin 88 per cent.

Dulness, manubrial prominence and a few veins show large thymus.

Tongue some coated. Double jaw jerk. Lower incisors show serration just across the tips (rachitic rather than luetic). Lower teeth irregular, one or more out of line. Somewhat high palatal arch. Tonsils not large. Nostrils narrow. Some palpable cervicals. Pharynx nearly full of adenoids. Scant thyroid. Splenic dulness not large.

Head max. circmf. 54, 6; wears same size hat as his father. C. I. 81, 5.

Pupils normal. Right eye a trifle the wider, and occasionally turns in. Facial grimaces at times, as on effort or if glasses are off.

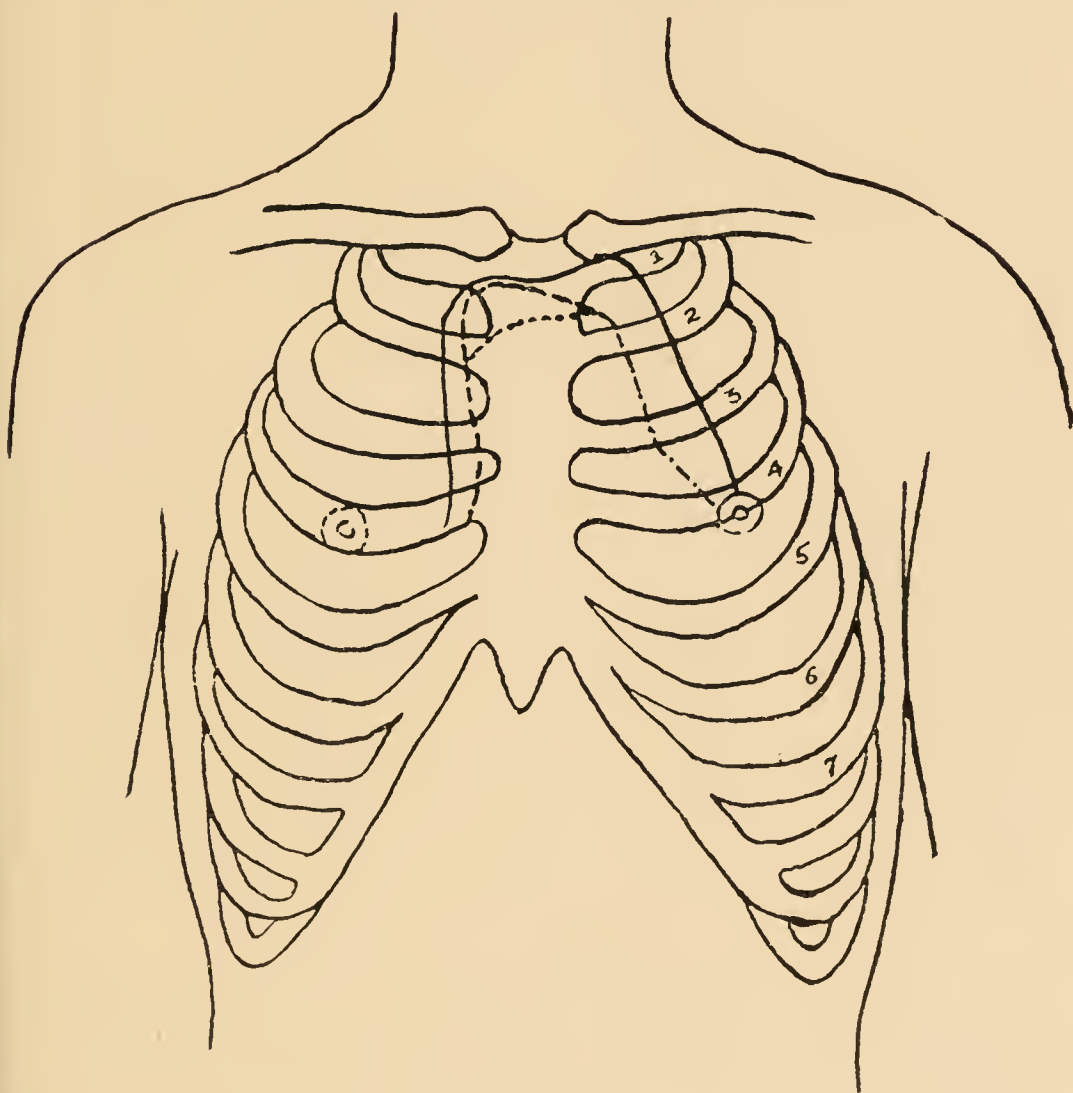
Report by Dr. F. B. Otis, November, 1913: "He has remained mentally undeveloped and has various physical defects also." Did not progress on thyroid. The adenoids have been removed.

Seen again, November, 1914, and January 1, 1915. Talks a trifle better than in 1911, including the stammer. Hesitancy and delay in speech. Some lisp. Voice still

childish. Some sounds he cannot utter perfectly, as l, sm, and sn.

Now in grade 4A, but promoted only "on account of his age and size." "He can't read."

Moderate lumbar in-curve. Belly sticks out. Vomited twice in six weeks. Wt. 127. Ht. 5 ft. $4\frac{5}{8}$ ins.



CASE 3.

(In these illustrations the broken and the dotted lines show stages of diminution of area of dulness following treatment.)

Clumsy. All movements slow. No arm jerk now. Scapulæ wing. Elbows hypotonic. Stout shoulder caps. He has always been knock-kneed (both sides).

P. 90, then down to 79. Systolic 105. First mitral now a mild bruit.

Some thymic veins, definite prominence of manubrium, and large dulness (drawn by Dr. Beers, November 7).

No initiative. Easily dyspnoic. Irritable at times. Somewhat timid and fearful. Cuts many grimaces; is in almost constant motation.

Some twenty-six small brown patches (pigment moles) over left side of face and neck; similar on right.

Admitted to Kings County Hospital, January 6, 1915. Promptly termed feminine by the internes, because of voice, skin, manner, etc. Reported by the nurse as exceedingly sensitive, even to tears from any slight matter. Three X-ray treatments, January 8, 17 and 22.

Reported, February 20.—Thymic dulness, reduced on January 20, is now found still smaller (*v.* chart). "There's been a great improvement since he came from the hospital" (January 27), says mother. "He's able to grasp things" mentally. "He does better in school than he's ever done." Enuresis began to improve while in the hospital (once there), and only twice since, while "before, it was every night." "His privates never developed," but have made a start the last few months.

No trace of stammer. Speaks freely. But still some lisp.

Case 4.—Boy, 11½ years. April, 1911, per Dr. R. W. Westbrook. Father German; mother English.

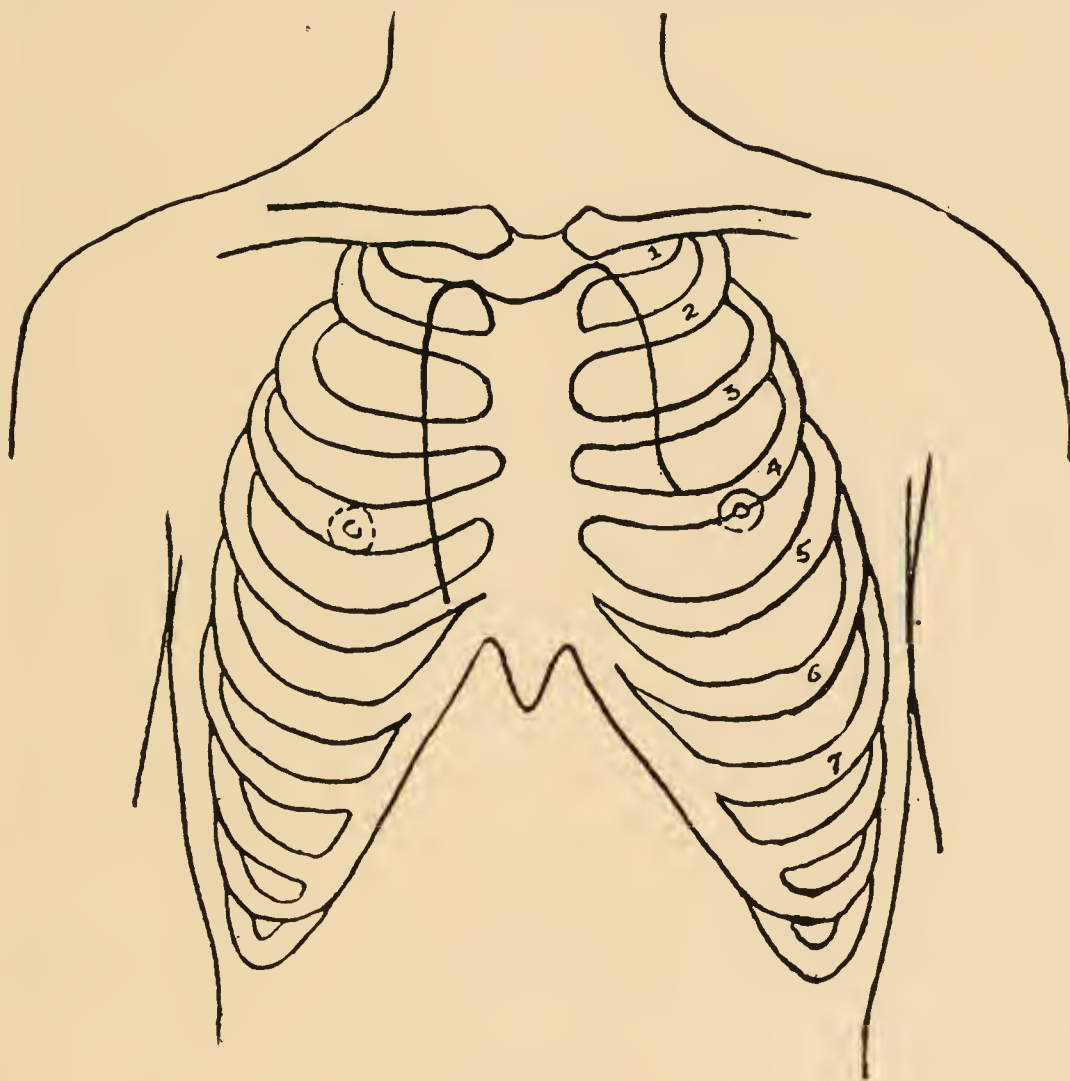
Oldest of three children. Non-instrumental. A puny baby, but thin rather than delicate. A fall at six months, but no bruise seen. When 18 months old, "he had the bloody dysentery very very bad" for about six weeks in the winter (not summer).

Is very ugly to his younger sister, but not so to other children. Kleptomaniac since six years old; "very sly," and never voluntarily owns up.

"He always did stammer some. He can't talk very quickly." Frightens and pales easily.

Is a good student; in 6B grade. Very active; prominent in school athletics; and makes himself liked.

A sound sleeper, 9 to 10 hours, mostly on belly with face covered, but some on back. Mouth dry mornings,



CASE 4.

and is probably a mouth breather. Occasionally talks in sleep. "Always so lazy," and now craves more sleep.

Large boy. Wt. 100 lbs. Ht. 5t ft. $1\frac{3}{8}$ ins. Well developed. A very peculiar eater—only hearty vegetables, lean red meats, hard boiled eggs, etc.

Head max. 55, 2 (short hair). C. I. 82, 3. Head easily affected by the sun.

Scapulæ wing moderately.

P. 66. Systolic 92. Slight blur to first mitral. Some accentuation of second aortic.

Two-inch wide thymic dulness (*v.* chart). No special prominence; but some veins radiating from the region.

Very freckled, dull square face. Slight droop to left lid. Large flat cervicals, apparently more on left. Always complains of dry lips. Thyroid seems scanty. High narrow palatal arch. Teeth small and poor. Left nostril about occluded; right fairly free. Tonsils small. Father "snuffles so"; the other two children sleep with mouth open and have adenoids.

Case 5.—Man of 33 years. November, 1912. Irish race. Third of five living children, plus five or six dead at various ages, but mostly young. Mother was a bad sufferer from asthma, and died at 57 of post-rheumatic heart-trouble. And the patient has repeatedly had rheumatism in feet.

Unconscious from fall on occiput at 10 years.

Does not use alcohol or tobacco. Was backward at school; in fifth grammar grade when he stopped at 14 or 15 years of age. Wears glasses since.

Stammers some, but not constantly; chiefly short hitches and repetitions when answering quickly or talking fast; duration indefinite.

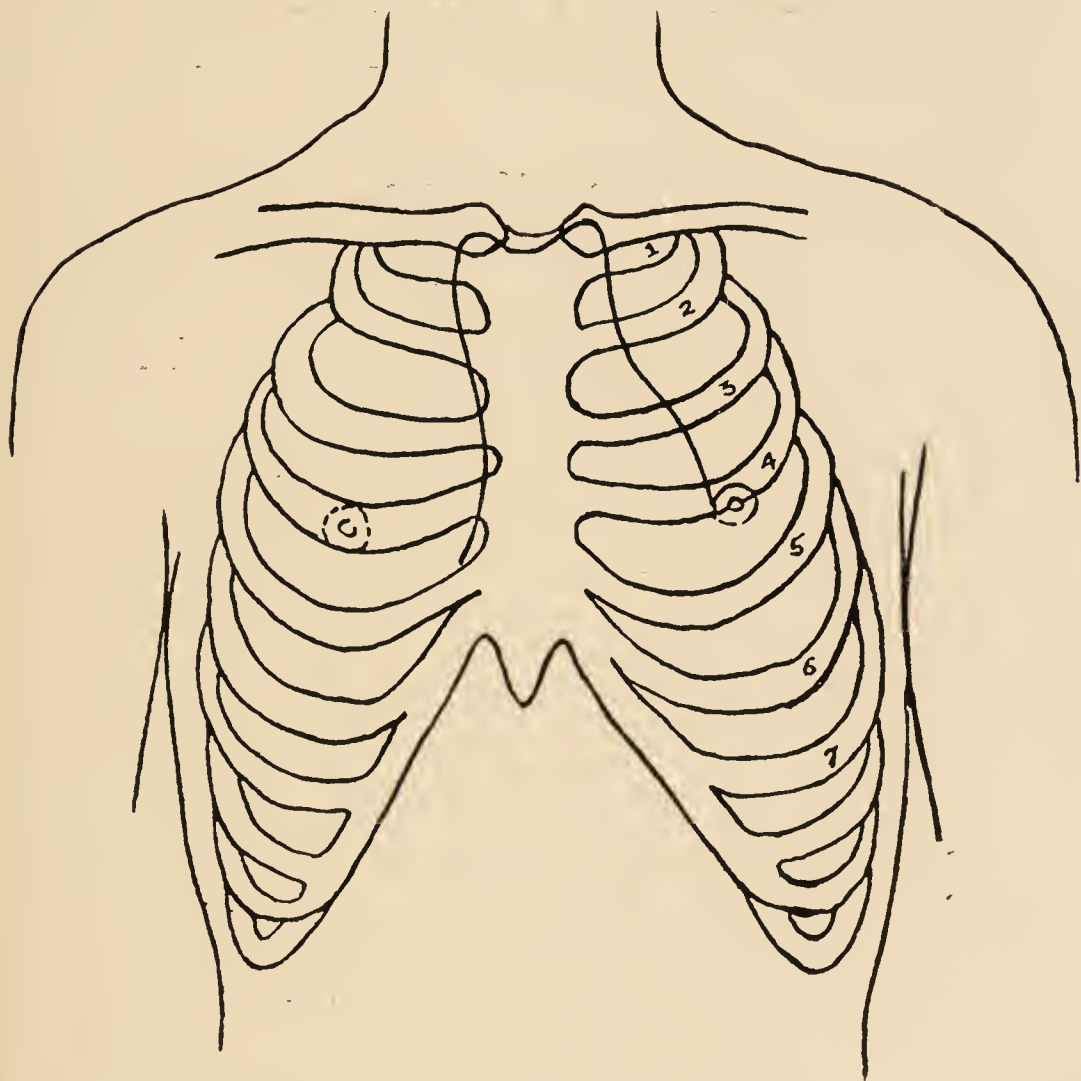
Chief complaint is seizures. Night attacks from 15 years on. Then a partly free period of 6 to 7 years. Now a definite epilepsy for a year. Numerous mild and occasional severe seizures (somewhat psychic in type at times).

Is a hearty eater "at all meals." "I drink a lot of water." Wt. 154 lbs. Ht. 5 ft. 8 ins. Bowels regular.

Sleeps soundly 9 hours, mostly on back. Nocturnal

enuresis now only at attacks. Shouts in sleep, but probably also as part of seizures.

P. mostly 72 to 96. Intermits frequently and persistently. Systolic 120. Sounds clear. Hemoglobin 98 per cent.



CASE 5.

Considerable thymic dulness (*v.* chart). Sternum flat. Max. circmf. head 57, 7 (thin hair). C. I. 73, 0. A blinker.

Is fairly intelligent. Memory imperfect, and failing. Tremor. Sweats easily. Some crossed jerk at knees.

Nostrils and pharynx narrow; cleared out in November, 1912. Strong double jaw jerk. Twice lost a tooth from

Rigg's disease; teeth otherwise good. Many moderate cervicals. Thyroid seems scanty.

Thymus X-rayed three times in October-November, 1913, with subsidence of thymic dulness; no more stammer. The epilepsy not greatly benefitted.

For six months in 1914 a series of boils about head, hands and body; no glycosuria. No recurrence of stammer.

Case 6.—Young woman, 19 years. January, 1912 (and December, 1913). Hebrew race. One younger brother was a bad stammerer; and another has suffered for three years from rheumatism of the heart. Troubles at home, father of violent temper, etc.

Did not begin to talk until $2\frac{1}{2}$ years old. In America 12 years. But stammered some before going to school in Russia. Graduated here from public school at 14 years. Since then, on going to business and feeling the impediment more, the stammer has increased. An excessive hitch and stammer. "Violent twitchings, can hardly utter one syllable." Contorts face and twists neck in efforts at speech. "Awfully nervous." Easily frightened, and then hands shake. Says she scatters motility in her efforts to talk. Hypersensitive to a degree. Jumps and starts up and down while attempting to stand quietly. Fascicular movements in arms. Hysterical at times. Variable moods; melancholy; thinks of suicide but is afraid. "I am too self-conscious."

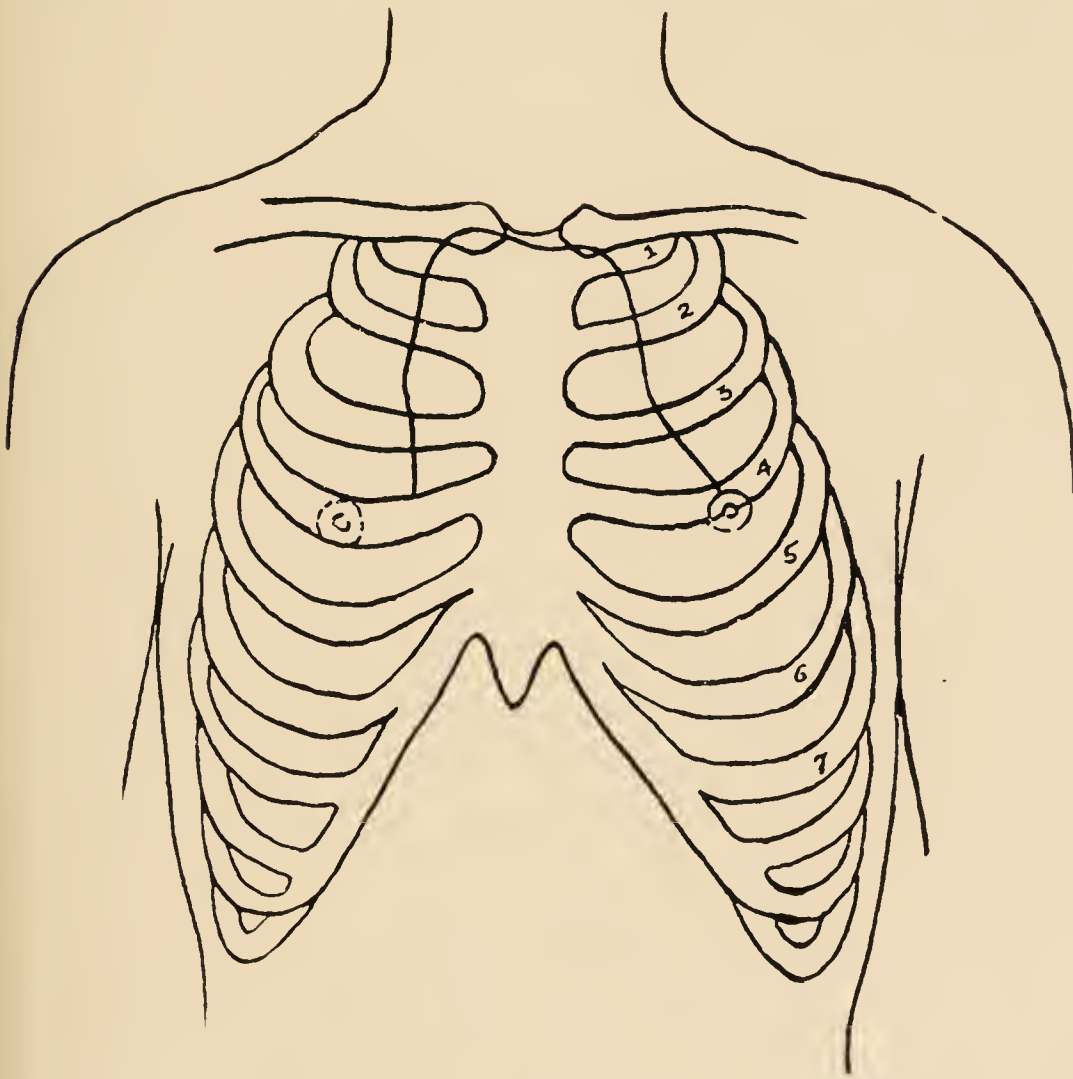
When alone, however, she can read or recite freely enough. Considers herself otherwise healthy.

Variable sleeper, 9 hours. May dream or be wakeful.

P. 80. Systolic 135. Cardiac sounds all clear. Yet evidence of circulatory defects (as a persistent short cough, steady complaint of dyspnœa on effort, desire to be always near a heater, and much accentuated second a. and p.).

Thymic dulness (drawn by Dr. Beers, December, 1913).

Elbows moderately hypotonic; fingers slightly. Scapulæ wing much; great vale between. Excessive incurve of lumbar spine. Irregular movements can be felt in the arms.



CASE 6.

Always eats more than most of family, and often between meals also. Tongue coated. Occasional belching. Bowels regular. Some cramps the last couple of years, and more at night. Wt. 135 lbs. Ht. 5 ft. 2 $\frac{3}{4}$ ins.

Low bridge of nose. A great "snuffler." Mouth usually a little open. Nose subsequently operated. Double jaw-jerk. A large mid-cervical gland on the right. Con-

siderable fuzz on upper lip. Lids heavy. Thyroid isthmus soft, at times seems scanty and again ample.

Max. Circmf. head 54, 5 (incl. much hair). C. I. 87, 2. One week of upper frontal headache.

An X-ray treatment in January, 1914. Reported 11 days later as more calm; was able to talk freely and naturally; thymic dulness at that time in abeyance. Unable to continue treatment; thymic dulness again became pronounced, though a little reduced, and speech variably involved.

Case 7.—Boy of 5½ years. July, 1913. Only child. Father American; mother German. Bottle-fed baby. "Very delicate the first year of life." First tooth at ten months. Adenoids and tonsils removed 2 or 3 years ago.

Often croup, recurrent bronchitis; cough troublesome, especially mornings.

Stuttering has increased of late; variable, at times excessive; may choke in his efforts.

Sleeps finely, 12 hours. Mouth a little open (also by day). May talk in sleep. Persistent enuresis. May yawn. Perspires, especially head and neck at night in summer.

A good eater, and much between meals. Vomits at times. Constipation. Wt. 35 lbs. Ht. 40½ ins.

Skin tans, and is very soft and delicate. Skin over abdomen and lower chest very brown.

P. 76-88-96-116-130 (at different dates). A first mitral murmur (known to be congenital).

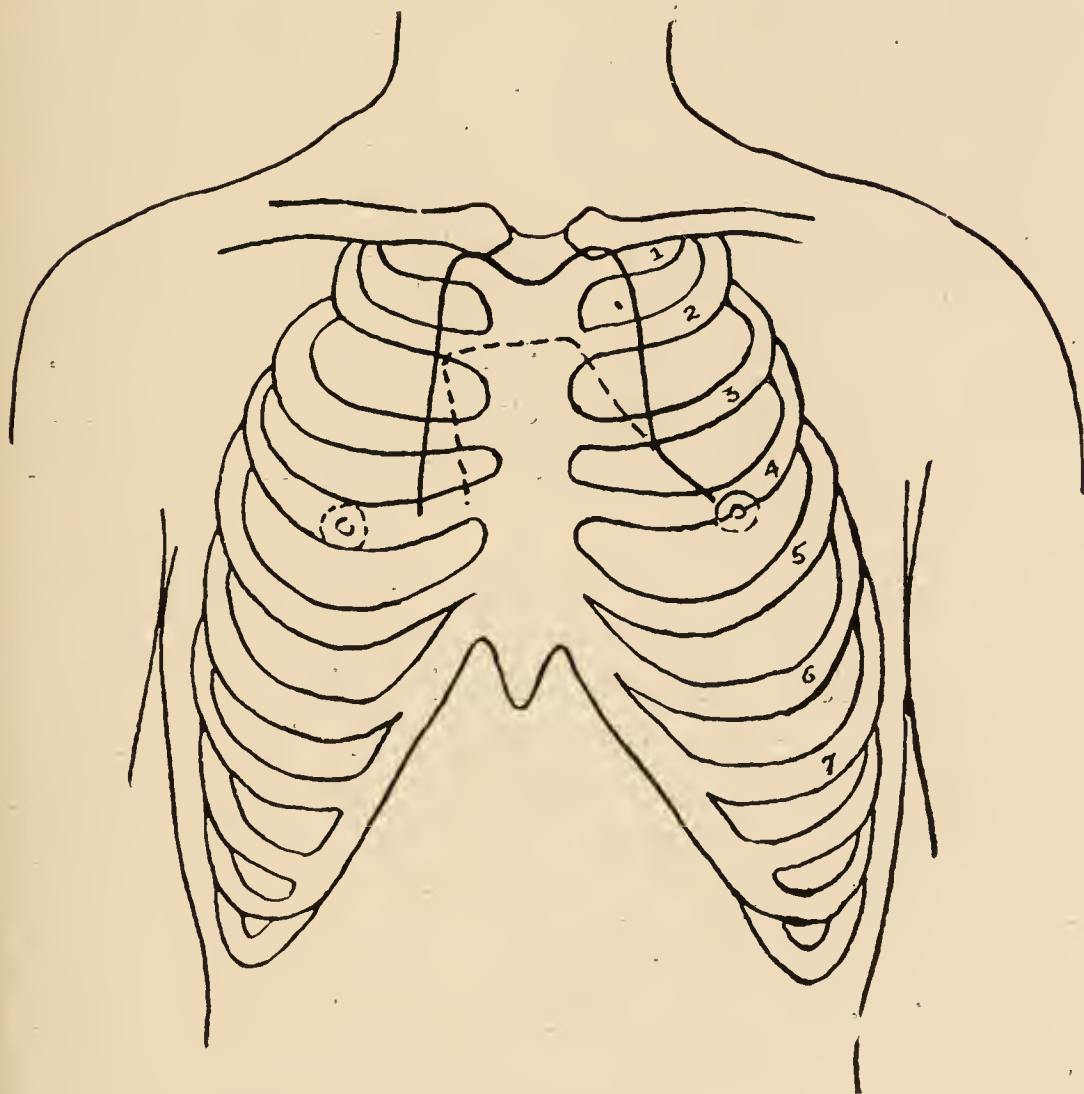
Precordial and epigastric pain; also variously about body.

Large thymic dulness, also veins and manubrial prominence.

Pectus carinatum. Usually piping and other rales over chest. Rectal T. 99 to 101 degrees.

Ample cervical nodes. Thyroid scanty. Teeth small but good. Tongue oft coated. Lids a little heavy.

Head max. 53, 5 (scant hair). C. I. 79, 8. "Cranky" at times. Very bright (precocious).



CASE 7.

Very active; always on the move; great chatterer; bites nails.

X-ray begun in November. Stammer and thymic dullness controlled. Then relapses of bronchitis, with return of most of thymic dullness, and partial recurrence of stammer.

July, 1914, no body growth in a year. Ht. $42\frac{1}{2}$ ins.

Case 8.—Youth of 15 years. June, 1913, per Dr. Smiley. German descent. Normal birth. Has three sisters, no brother. Father and his family “rheumatic.” Mother “very nervous,” and had bronchitis.

Appendix removed at 5½ years; never stammered before that; trouble with nose and ears right after.

“A nervous boy, diffident.” Excessively ticklish and hyperæsthetic:—“You can’t touch him.” Occasionally “cranky.” “Head always clear.” Is now in grade 8A.

“A ravenous eater”; constantly also between meals. “He ought to be stouter with all that he eats.” May belch. Extremely fond of tea and coffee, but stopped.

A pseudo-appendical attack six weeks ago; worse in speech and in all ways since. Now almost impossible for him to articulate.

A long sleeper, 10+ hours; at times on his back; mouth open; very restless. Was long a bed-wetter.

The last few weeks peculiar mild seizures every couple of hours to ten minutes; but not at night until later; stares, bites, grabs and cannot let go, may throw things; closes eyes, but can still answer simple questions; easily startled by any sudden noise or fright.

Spare build. Very boyish, pleasant face. Soft pink complexion; hands chap all the time in winter. Not a perspirer; but inclines to feel cold even in summer. One hairy mole and at least fifteen small and large pigment-moles on face and neck. A slight dry scaling of skin over trunk and extremities has long been noticed.

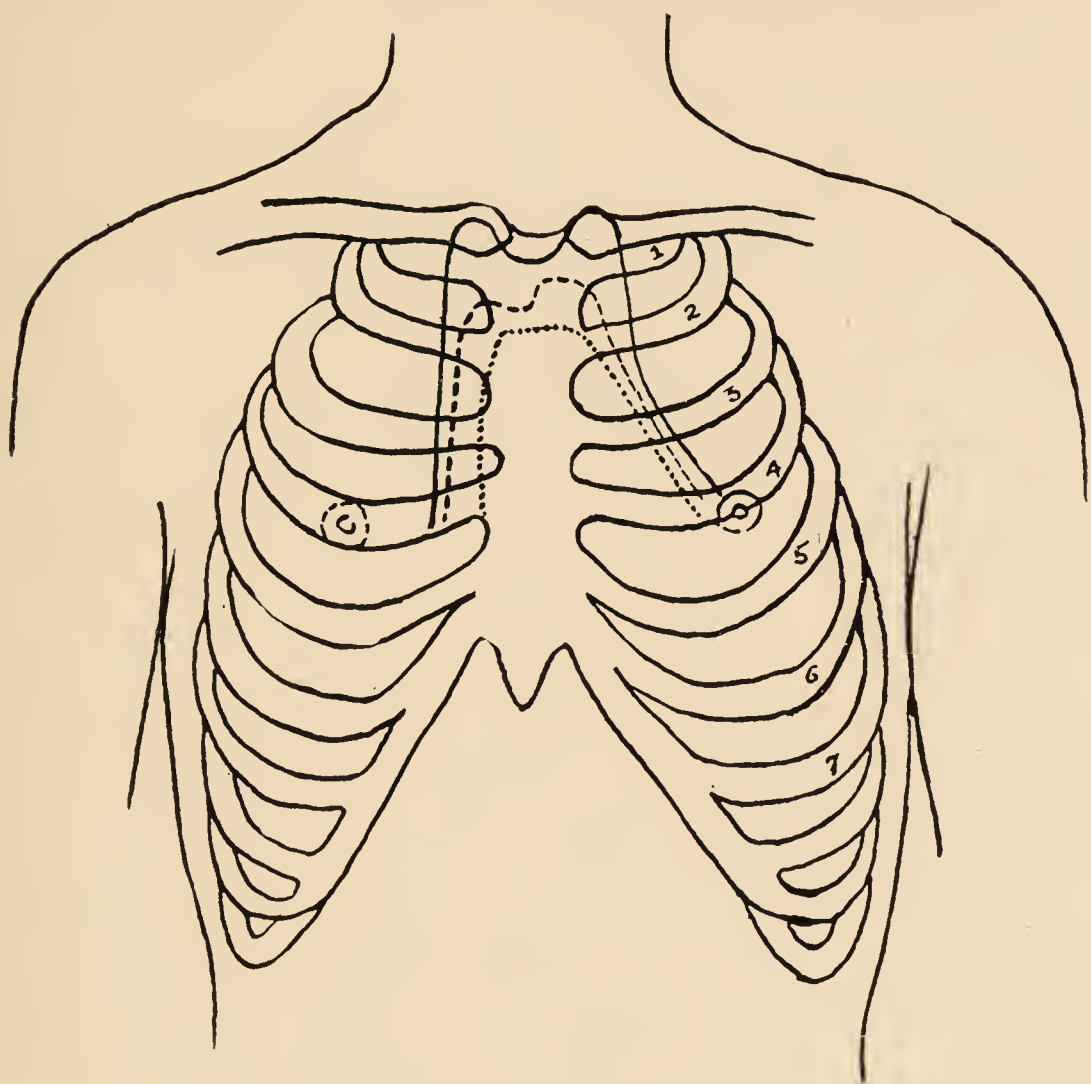
A halting, struggling, gurgling stammer. Childish, high-pitched voice. Mannerisms.

Wt. 101 lbs. Ht. 5 ft. 6¼ ins. Abdomen relaxed. Tires easily, and inclines to idle.

Marked fine tremor. Great nail-biter and knuckle-sucker. Scapulæ wing much. Hypotonic elbows and fingers. Very knuckly small joints.

P. 88 to 72—varying and half-intermitting persistently. Systolic 101. Sounds clear; accentuated second aortic. Hemoglobin 95 per cent. Dyspnoic tachycardic and frightened on attempting to swim.

Thymic dulness; slight fulness of manubrium; faint precostal veins. Chicken-breasted; costal flanging be-



CASE 8.

low; marked sinking-in of lower sternum. Visible and palpable though not great sterno-manubrial angle.

Many large flat cervical glands. Long thin neck. Scant chin. Broad thin thyroid isthmus. High narrow palatal arch. R. nostril very narrow; L. open. Very irregular teeth. No jaw or throat jerk. Blinks some.

Max. head circmf. 52, 0 (fine hair only). C. I. 87, 2.

December 29.—Seizures much less frequent. Stammer unchanged. First X-ray. The largest outline of chart represents the thymic dulness at this time.

Second X-ray on January 5, 1914.

January 25.—Speech improvement remarked by outsiders. The next lower outline shows the extent of shrinkage at this time, *i. e.*, 27 days after the first and 20 days after the second X-ray treatment. By this time he was able to utter sentences of considerable length without hitch.

A cough for a couple of weeks, first of March, brought some recurrence (thymus and stammer). Another X-ray on March 4 and again on April 8.

May 14.—Thymic dulness gone. Speech much improved.

September 9.—Again some return of thymic dulness, especially on the left. Received another X-ray.

November 17.—No spell in three weeks. No stammer. No thymic dulness. P. 72. Systolic 115. Ht. 5 ft. 7¼ ins. Wt. 115 lbs. Appetite less. The past summer he has perspired some.

February 18, 1915.—Thymic dulness now just up to the top of the sterno-manubrial ridge. Progressing well in studies. Scapulæ now nearly flat on chest. Seizures only mild and every two or three weeks. Though speech is still good, another one or two treatments may presently be advisable.

Case 9.—Male, 2 years, 1 month old. For Dr. O. Cohen, September 15, 1913. Hebrew race. Instrumental delivery (as was the only other child); 7 hour confinement. Nursed 13 months. First tooth at 5 months. A little constipation and fever with some teeth.

Began to walk at 13 months, and to talk at 15 months,

though "papa," "mama," etc., earlier. No stammer in relatives.

Spoke perfectly until he fell off a bed on July 25, giving the back of his head "a dreadful knock." It was not until a week later, on August 1, that he started to stammer a little. The week after the fall he stopped eating, and does not yet eat as much as formerly. His stuttering is steadily increasing, so that now he says a word "a dozen times" before proceeding. Worse yesterday, with much cooler weather. It is the first word that he repeats so much, and then may finish all right.

Very active here; almost destructive. Fair skin. Wt. 27¼ lbs. Looks fairly healthy.

Pupils equal and medium. Short stubby neck. Some palpable cervicals. Thyroid seems scanty. Low bridge of nose.

Sleeps all night, 10½ hours; may waken or be restless. No enuresis now 2 or 3 months.

Max. head 49, 0 cm. (incl. some wavy hair). C. I. 80, 9.

P. 96. Some first mitral bruit. Marked thymic dullness; also a border of veins all around the area.

October 1.—Reported by Dr. Cohen as "markedly improved" in speech, and gaining in weight.

Case 10.—Boy of 9²/₅ years. October, 1913. American descent. An only child. There have been three or four "misses" since. Mother somewhat of an invalid.

Never spasms. Diphtheria at 7. Measles at 9.

At school he skipped one class a year ago; but was left back one grade this summer. To mental tests he made a good showing.

The teachers tell parents of his "bad" actions. "Past year, bad reports"; "he doesn't mind." "He seems to lack interest in his work," may leave it unfinished. Not

malicious, but disposes of things foolishly. "Very stubborn and persistent." "He is continuously on the jump." Tantalizes teacher and parent, and tells lies.

He is a pronounced stammerer. "He's been ridiculed," and this makes him stammer worse.

Is spare and pale. Cries easily. Takes "colds." Very thin, fair skin. Sleeps 11 hours. "Talks a good deal in his sleep." Mouth open. Enuresis better, but still "about once a week."

He usually eats, but amount varies. Wt. $70\frac{1}{2}$ lbs. Ht. 4 ft. $7\frac{5}{8}$ ins. Slim neck. Ample cervicals. Yawns. Ears wing. Max. circmf. head 52, 6. C. I. 79, 8. Narrow thyroid isthmus.

Gape-mouthed. Tonsils small. Nostrils partly open. Adenoids. Some double jaw jerk. Some new incisors; other teeth carious. No notching; but two upper incisors are prominent and project in front of lowers.

Fine tremor of hands. Bites nails. Hypotonic elbows and hands. Fair radial jerks. Is naturally left-handed. Winging scapulæ (stoop-slouch).

P. 90. Systolic 102. Sounds clear, except a trifle blurring of first mitral.

A specially large thymic dulness. Some prominence of manubrium; and ample plexus of precostal veins.

Case 11.—Youth of 15 years. December, 1914. Father English. Mother has had uric acid.

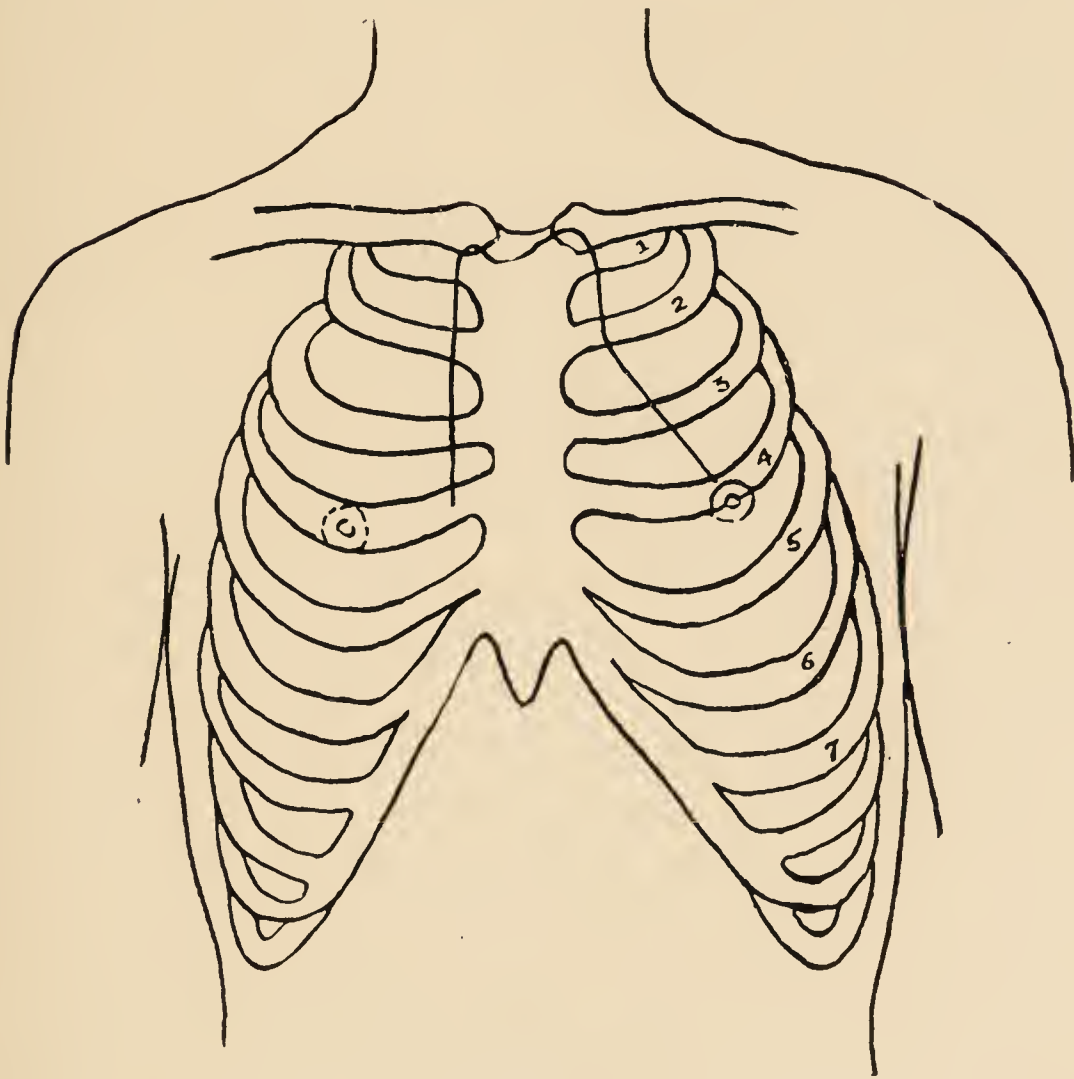
In an auto accident in 1907, and has stammered since. Adenoids removed when about ten years old.

"Does fairly well in school"; is in 8A. "Very sensitive." "Awfully scared." "Gets mad and cries easily." "Sort of emotional laxity." No endurance.

Sleeps well, long and late. Dry mouth mornings, and probably a mouth-breather. Enuresis to within his recollection. Yawns some.

"I eat fine" and even between meals. Wt. 114. Ht. 5 ft. 5+ ins.

A bright looking boy. Stammers so badly that often he is unable to give information about himself.



CASE 11.

Neck small in relation to head and heavy shoulders. Enlarged cervicals. Thyroid isthmus narrow. Average, not great, jaw. Max. head 55, 0. C. I. 88, 2. Hair dark. Spleen not specially large. Narrow high-arched palate. Teeth irregular; one below is quite out of line. Slight odor to breath.

Elbows hypotonic. Is right-handed. Marked winging of scapulæ. Slight lateral curve to left in lower dorsal

spine. Great lumbar incurve. Prominent abdomen. A slight first mitral bruit. Systolic 120.

Ample thymic dulness (as per sketch). Plexus of typical upper prethoracic veins.

Considerable sinking-in of sternum especially downward. By correcting posture he can always increase the antero-posterior diameter of his chest an inch.

Case 12—Man of 41 years. October, 1913. American. Manufacturer. Sent by Dr. C. F. Barber, because of morbid fear of some disease. Mother and sister died of tuberculosis. Father had sciatica.

A son of 15 years. One "miss" since. Been no other. Venereal denied, and Wassermann negative.

Comes for a difficulty in walking for the last couple of years, and variable numbness in legs. Calves get "knotted up." Tires much more readily.

"Hearty" eater even for breakfast. Wt. 165 lbs. Ht. 5 ft. 10 $\frac{3}{4}$ ins.

Sleeps poorly, 10 $\frac{1}{2}$ hours. Not a dreamer, snorer or mouth-breather. Night-sweats up to last 3 or 4 years. Nocturnal enuresis up to 8 years of age.

Somewhat of a stammerer all his life; though less, he still shows it. Talks very deliberately.

No tremor. Is right-handed. Little fingers a bit mongol. Elbows extend just to straight. Each arm shows all five jerks. Scapulæ not definitely projecting.

Normal patella achilles and Babinski jerks. Slight crossed jerk. No clonus nor Romberg. Both plantar arches gone. "Come down altogether on the heels."

Pupils react to light. Thyroid seems scanty. Some palpable cervicals.

P. 68. Systolic 112. Sounds clear.

Thymic dulness present; also the veins in front, and prominence of manubrium.

Impetuous, quick, restless manner. Timid personality, over-fearful to a degree.

Case 13.—Boy of 10 years. Admitted for chorea to Kings County Hospital, November, 1913. Father healthy but of dull mentality. Mother died insane, and an older brother was for some months in an asylum.

Patient has been in a "home" for some years. Chorea began a year since. Is a moderate but not quite constant stammerer. Nightly incontinence of urine.

Fair, soft complexion. Numerous enlarged cervical glands. Some adenoids. Typical Hutchinson teeth. Tonsils a little enlarged. Is a big eater.

Max. circmf. head 50, 8. C. I. 84, 0.

Loud systolic murmur at apex. Systolic pressure 90 mm.

Mild choreic movements of hands and feet, and general uneasiness. No special rise in T.

Scapulæ wide apart and wing moderately. Hypotony of elbows.

Though looking bright and pleasant, he proves to be much retarded mentally. Uses oaths and other bad language to the nurse.

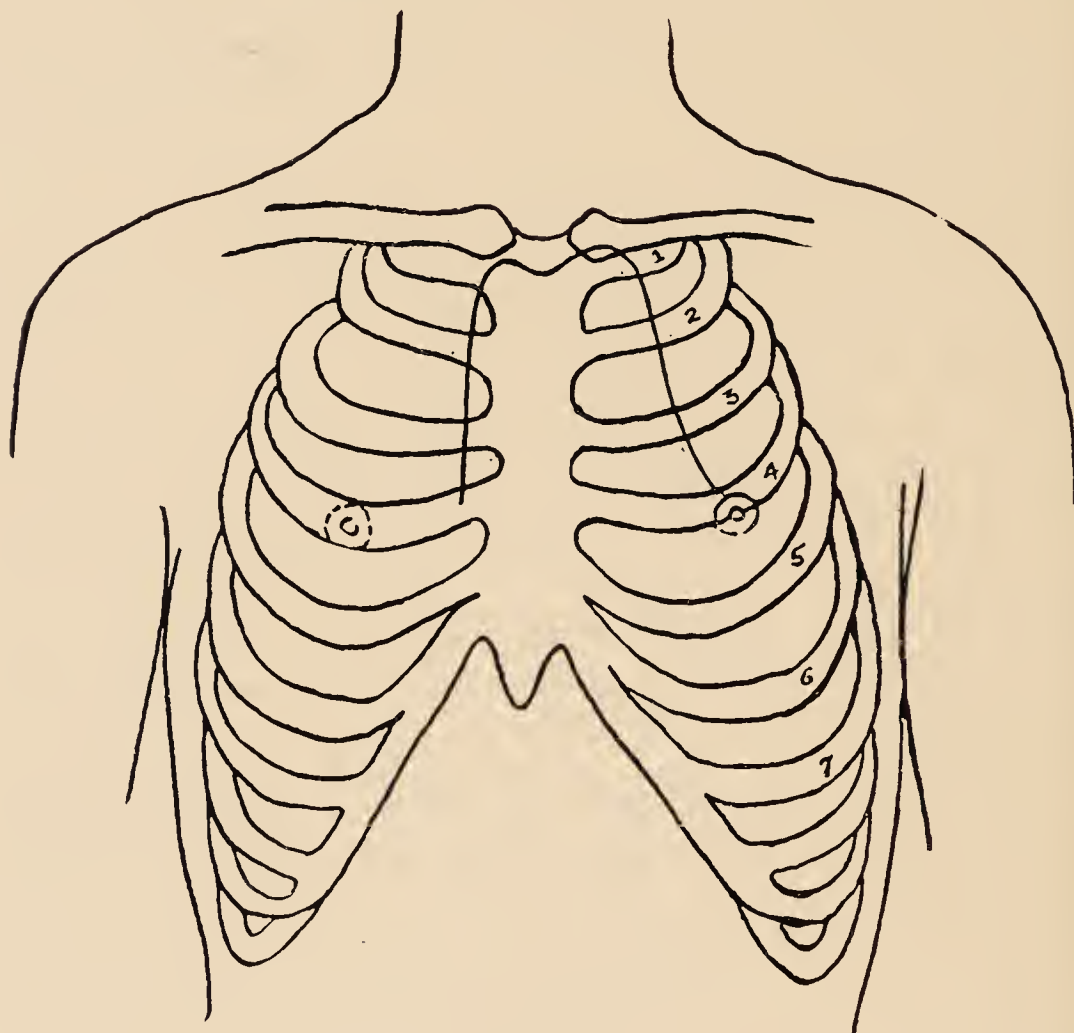
Rest in bed for three weeks and iodine preparations internally improved the chorea but did not influence the stammer.

Accompanying sketch of the thymic dulness was made by Dr. Beers, December 5. First X-ray treatment of thymus on December 8, and second on December 21.

One week after the first X-ray the thymic dulness was gone (verified December 24), and the stammer was distinctly less. By December 25 the stammer was apparently cured (an occasional trace according to the nurse); enuresis reduced to less than half the former frequency though not as radically benefitted as the stammer. Bad

words controlled and mental dulness less evident (partly perhaps from training). The cardiac condition persists, showing that this can be but a contributing factor.

Readmitted a month later to another ward for his heart trouble; but without trace of his stammer (corroborated



CASE 13.

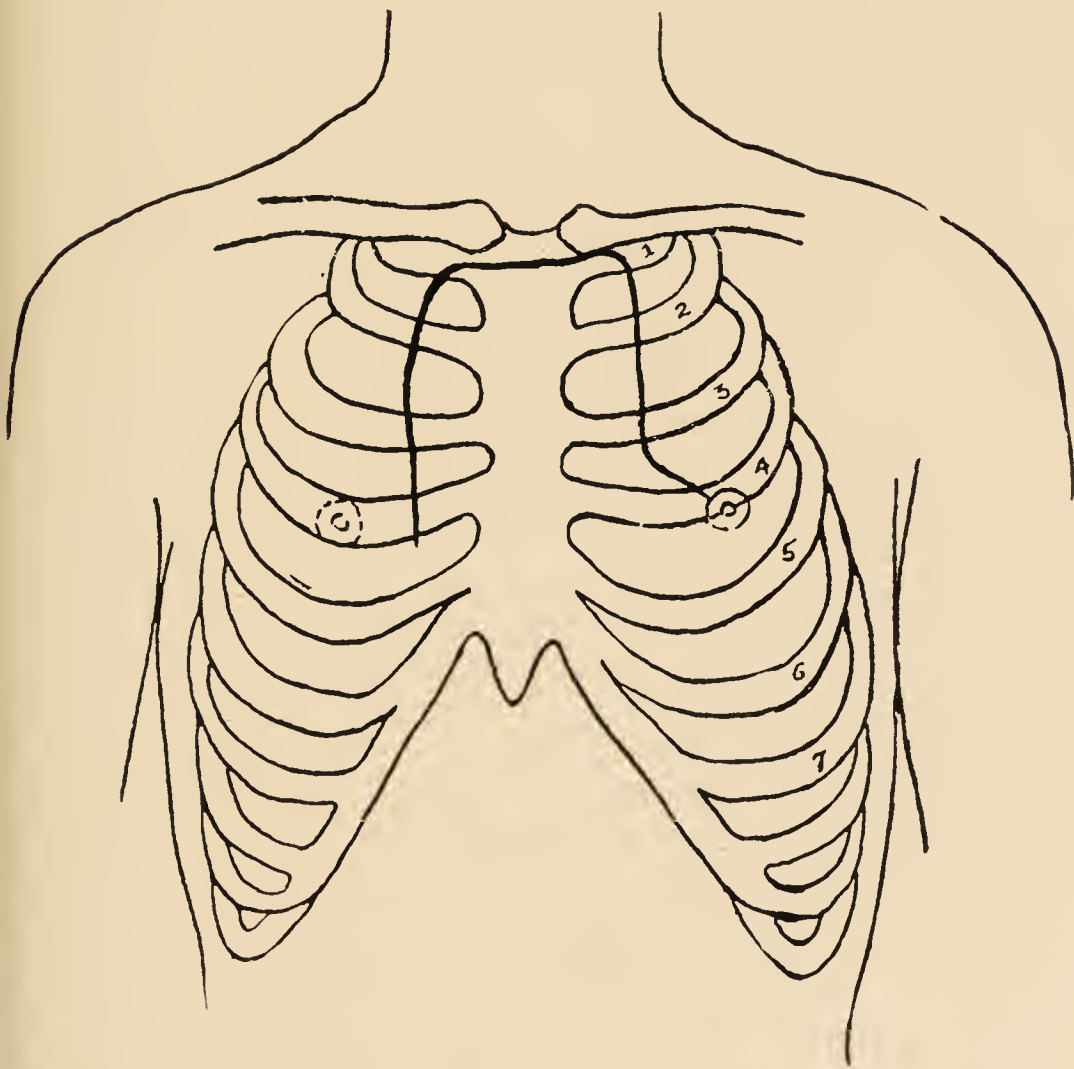
by the nurse). His enuresis had entirely subsided, language without reproach, and mentality nominally that of a boy of his age.

February 17, 1914.—No enuresis. No stammer. Used bad language only once when started by another boy. Mental deficiency noted by the nurse—slightly simple.

Case 14.—Boy of $4\frac{1}{2}$ years. January, 1911. American descent. Oldest child. "Adenoids from birth," re-

moved at 16 months, and again later. Slow in learning to walk, "always on his toes" (slight congenital spasticity).

In the heat last summer he developed an ulcerative hemorrhagic colitis with "convulsions" or "little short



CASE 14.

jerks." T. to 106 deg. F. In bed six weeks, and emaciated. His hair fell out during the autumn.

Has always stuttered some, as does the mother at times.

Has been in no pain unless some rheumatic touches in right knee and abdomen. Favors the right leg the last four months, but steps up with it first. Knee-falling

(astasia-abasia) at times. Just good knee jerks. While sitting, can lift one extended foot as well as the other.

Sleeps 12 hours straight; mouth open. No enuresis. Not a snorer. "He complains of being tired." Sighs some.

Wt. 35 lbs. "He's a tremendous eater."

No cardiac bruit. Definite thymic dulness, 6 cm. across at the widest. Also some thymic veins.

Is active and bright. Cervicals not large. Thyroid seems scanty, but did not do well on thyroid.

June, 1914.—Still a great stutterer.

Winging scapulæ (Spitz-blades with tips sticking out). Elbows and finger-wrists hypotonic. Is left-handed like his father. Hypotonic S-body with marked lumbar in-curve and considerable pouting of abdomen. Never short-winded. Many facial moles.

Still a pronounced mouth-breather. All cervical glands lumpy, round, hard, moderately enlarged. "Tremendous appetite; digest anything; always hungry."

Ample thymic dulness (sketched to-day by Dr. Beers). On lower front chest some old rachitic changes. A very fair skin. A plexus of veins shine through skin of upper front chest.

Case 15.—Italian girl of 13 years. December, 1913.

A younger brother also stammers a little.

Patient is a pronounced stammerer; has stuttered since she was three years old.

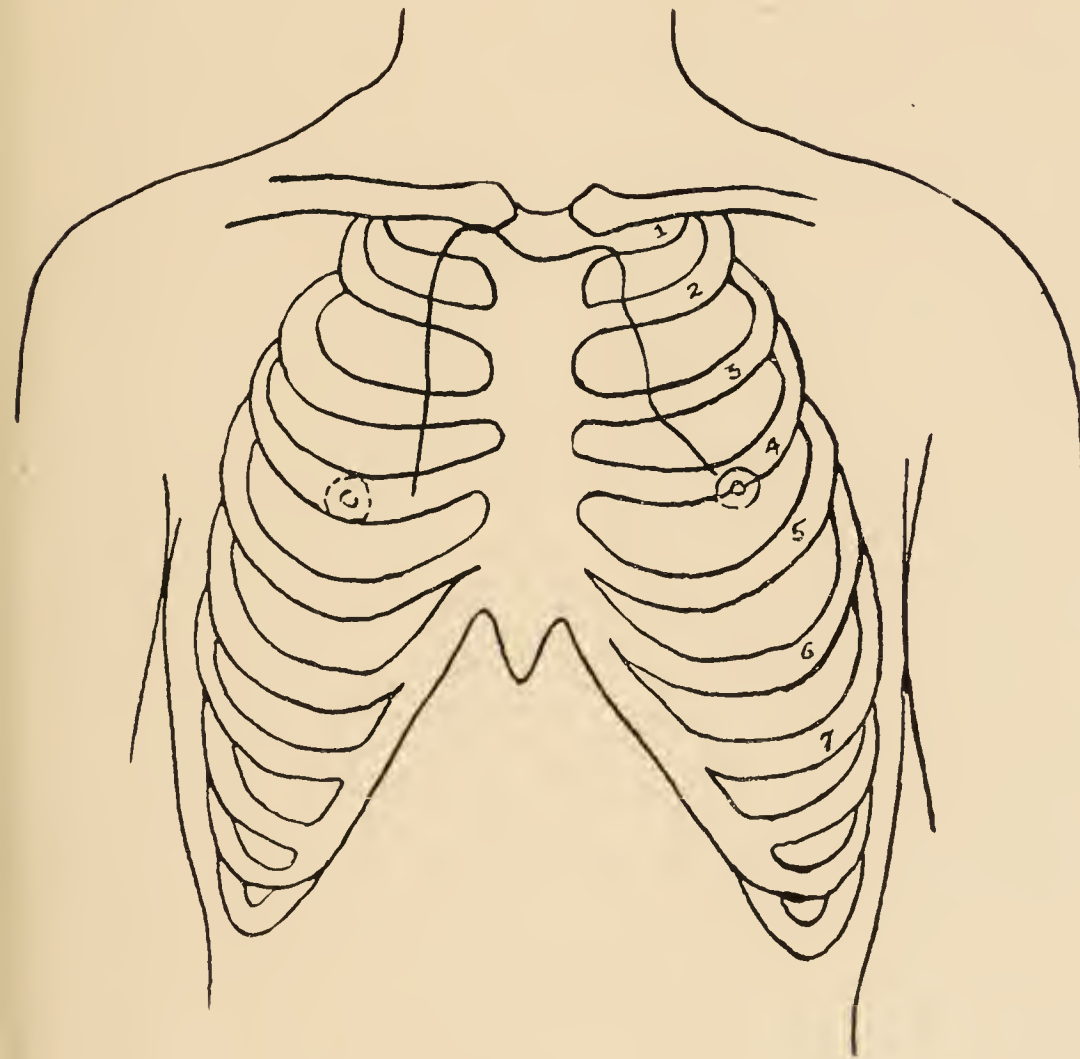
An old-looking face.* Is undersized. "I'm skinny." Wt. 53 lbs. Ht. 4 ft. 7 ins.

Many large cervical glands. Scapulæ stand apart and wing distinctly.

* Suggesting a degree of "progeria" of early presenility, which Sajous (*N. Y. M. J.*, 1915, I, 587), attributes to defective thymus, though it was enlarged and fibrously degenerated in one case that he cites. As a rule, however, stammerers give the impression of an over-youthful physiognomy.

Cardiacs show something amiss with a first sound, probably aortic.

Thymic dulness, with somewhat indefinite demarcation along the upper lateral borders (drawn by Dr. Beers).



CASE 15.

Case 16.—Boy of 14 years. December, 1913.

A good stammerer.

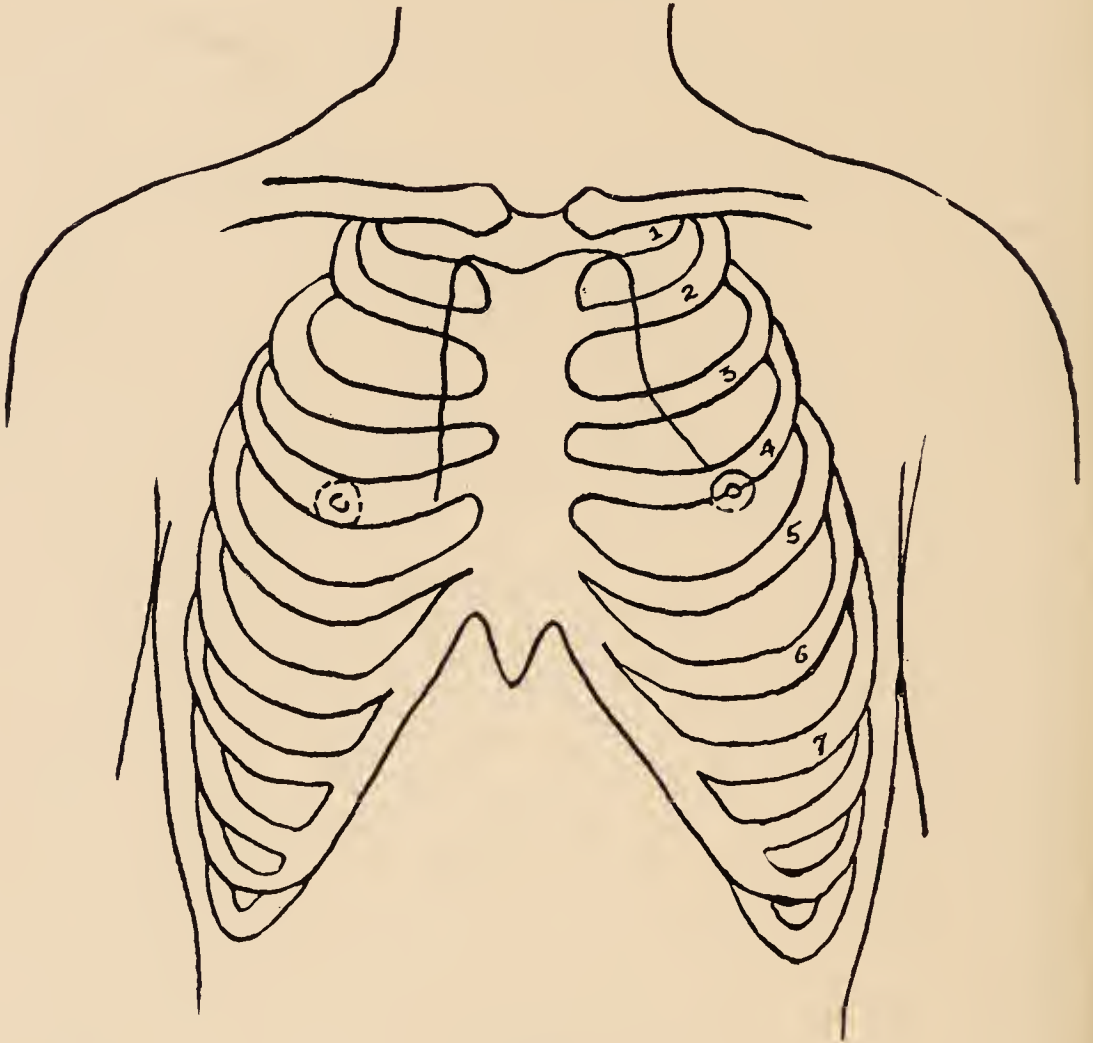
Is under-sized. Wt. "about 80" lbs. Ht. 4 ft. 10 ins.

Numerous medium-sized cervical glands. Scapulæ wing markedly.

Aortics clear. A distinct, somewhat long, first mitral murmur.

Thymic dulness. Many veins over front of upper chest. Sketch by Dr. Beers.

Case 17.—Boy of 14½ years. February, 1912. Is an only son, and youngest of five children. One of them



CASE 16.

stammered for a short time. The mother has a trace of it—speaks very slowly with effort and care.

“He’s not been a robust child.” Subject to pains in the stomach off and on. Rarely complains, but may of headache and percordial pain.

About two years old when he began to talk. “He’s been stammering right along.” Is in a transition class, perhaps one grade slow.

Sleeps 10 to 11 hours; jumps and twitches all over and continuously. No nocturnal enuresis since infancy.

Is timid and fearful. Wt. 84 lbs. Ht. 5 ft. $\frac{7}{8}$ ins.

Scapulæ wing moderately. Great nail biter.

Teeth, gums, tongue fair. Tonsils not vast. Right nostril narrow. Max. head 54, 2 (incl. slight hair).

P. about 60, but variable, almost intermits. Tension 122. A dull long first mitral murmur.

Thymic dulness. Also a spread of upper front chest veins.

Case 18.—Man of 27 years. October, 1904, with Dr. McAveny. Of English-Irish stock. Has two brothers and one sister.

As boy "too fond of playing truant"; left school at 13 or 14 years of age, in fourth grammar grade. "I was very tall when I was young," which made him conspicuous and sensitive. Stammered "when I was a young boy," and some ever since.

First came for a nervous condition of generally spastic character. This improved under iodide, so as to be considered cured. He then entered the U. S. Navy, and served for some time.

Retrogression later. Agin seen at the Polhemus Clinic, January, 1909. He next came under notice at the Kings County Hospital, February, 1914. One account will cover all findings.

A history of recurrent numbness and slight weakness of either side from time to time since some episode in youth—"I and excitement don't agree." Tonsillitis many times; tonsils, somewhat large, removed about 1910.

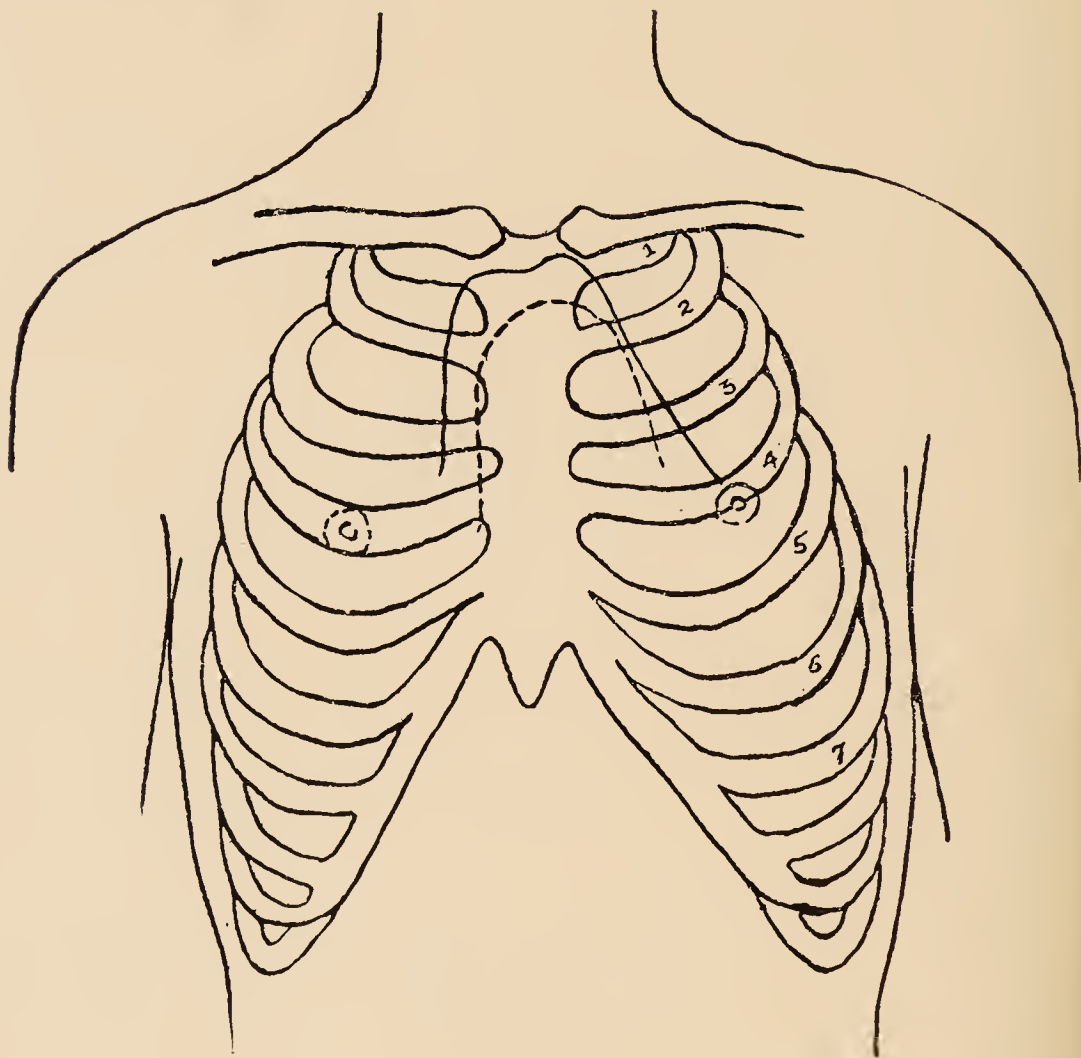
Spinal puncture in winter of 1913-14 is said to have proven negative to Wassermann.

Is sensitive, appreciative and inclined to melancholy on any slight cause. Not a perspirer.

Sleeps mostly on back; thinks mouth shut; but mornings it is dry.

Stammer is not of the dammed-up, struggling type, but hesitating, repeating in character.

"I can eat to beat the band," more than either of his brothers.



CASE 18.

Spare habit. Inclines to be pale. Round small boyish face. Chin rather small. Ht. 5 ft. 11 $\frac{5}{8}$ ins. Wt. 154.

Fine tremor. Elbows very hypotonic; hands somewhat so. Mongol little fingers. Arms show good radial and some flexor jerks. Scapulæ wing moderately (no diastasis).

Marked lumbar incurve. Moderate abdominal pout.

Very spastic gait. Strong direct and crossed jerks. No clonus. Normal to Babinski test. Sensation normal to gross tests. Distinctly bow-legged both sides.

P. 86, not quite regular (1904); dull thumping rather than distinct murmur (1909); the long first mitral blur at apex now amounts to a murmur (1915). Some precordial pain. Systolic 141.

Thymic dulness (chart of February 8, 1914). Considerable veining over upper front of chest.

Whole lower sternum much sunken. Also transverse or Harrison's groove. Definite sterno-manubrial angle.

Pupils normal. Slight irregular nystagmus, chiefly on oblique vision. Eye grounds normal (1909). Ears wing moderately. Numerous large cervical glands. Cubitals also papable. Conical-domed palate. Teeth badly decayed. No jaw jerk. Thyroid scanty. Max. head 56, 0. C. I. 80, 9.

First X-ray treatment of thymus on February 8, and second on 21st, 1914. Thymic dulness promptly subsided, and stammer followed.

February 28, 1914.—Leaves hospital. No stammer noticeable; said by nurse to show a trace an instant when excited. He reported as good in September.

March 5, 1915.—Again examined. The stammer has partly returned; also the thymic dulness as shown by the chart. Even the spasticity has been benefitted so that he can act as night watchman on dock.

Case 19.—Boy of 11 years. Admitted to K. C. Hospital, February, 1914. Is the third of six children; others free. Hebrew. Has stammered since six years old.

Short and small for his age, almost infantile but well proportioned and not spare. Ht. 51 inches. Fair soft skin.

Sleeps well, 8 hours. No enuresis. A mouth-breather. Slight neck. Many large cervical nodes. Thyroid isth-

mus scanty. No torus, but somewhat high palatal arch. Both nostrils about occluded. A great blinker. Face contorts as he starts stammering. Head max. 52, 0. C. I. 86, 0.

Bad stammer, speech ties up. When once started he can say alphabet or familiar things fairly. But the impediment is so great that it is impossible to get much information from him. Mentality difficult to determine, but seems fairly bright. Is in 5A grade. Nurse reports that he uses "awful language" at times.

Is a very large eater. Splenic dulness 9 cm. long.

Scapulæ wing. Hypotonic elbows and hands. Belly bulges moderately. Overcurve forward of lumbar region.

P. 75 to 78. Presystolic thrill; tumultuous action of heart; double pulsation in jugulum (reclining); a long first mitral bruit. Systolic 95.

Large thymus, especially to left and a high cornu on that side (drawn by Dr. Beers, February 17). Many pre-costal veins, not over manubrium but well out and downward.

Depression of lower sternum; definite manubrial angle; slight Harrison groove; and the palate, and dwarfism, indicate defective early bone growth.

First X-ray treatment on February 15. Two hours later a marked increase in the area of thymic dulness was evident, chiefly out and upward to left.

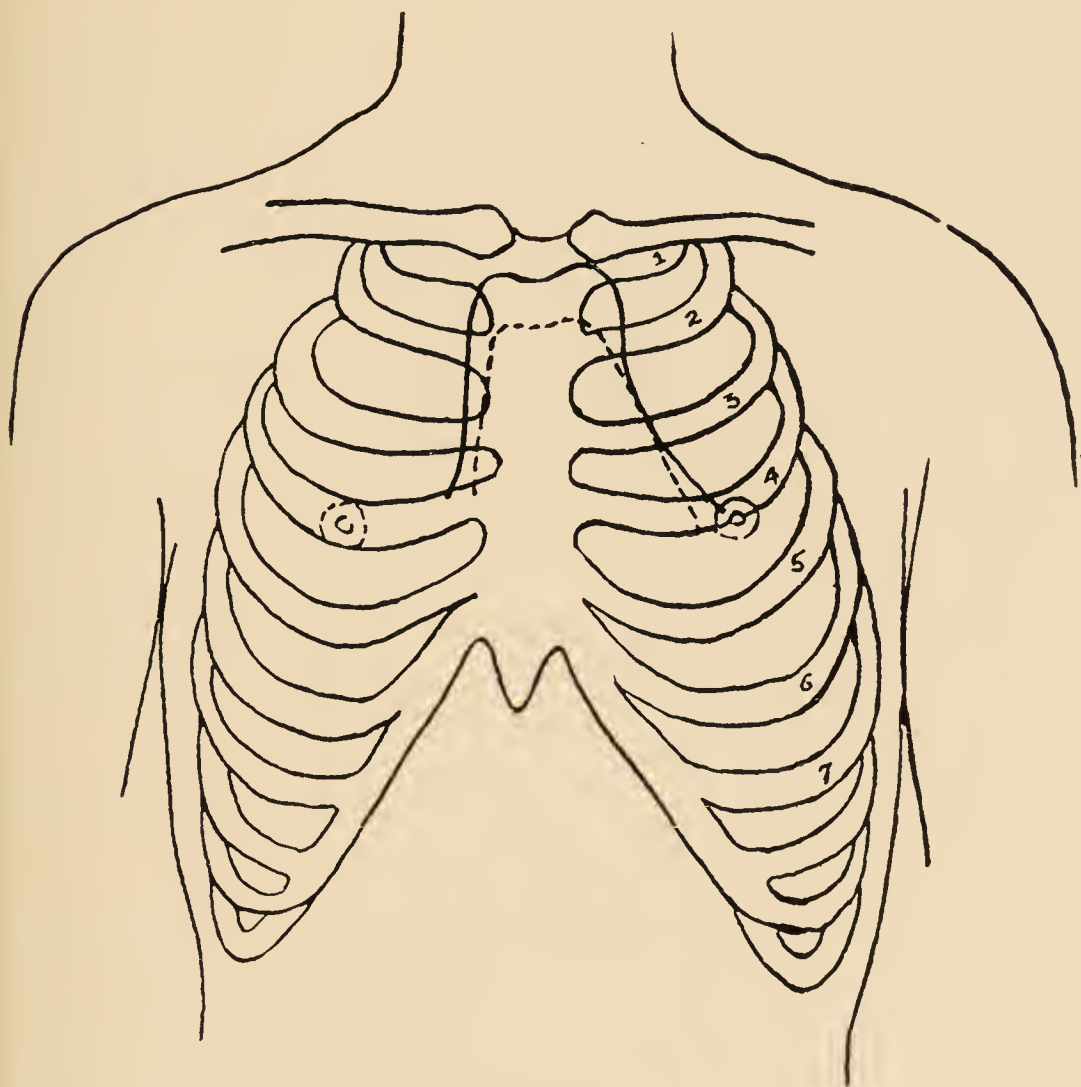
February 19.—Dulness now reduced. Largely returned by the 24th, when he had second X-ray. Twenty-seven hours later the dulness had increased again to a little beyond the original marking.

February 27.—Stammer reported less. The T., which had shown a variable rise, now 98, 0 to 98, 4 degrees. Third X-ray.

He had one or two more treatments, the stammer

improved further (as stated by mother and nurse) so he could make simple replies without a hitch, though still stammering some; thymic dulness lower. Returned to school.

October 11.—Improved for a few weeks after going



CASE 19.

home, not since. Can talk well after getting started. Wt. 70 lbs. Ht. 53½ inches. P. 72. In 5B class. Whole right border of thymus shows contraction.

Readmitted to hospital. X-ray on December 28, and again January 4.

January 10, 1915.—Now talks freely most of the time, but may catch a trifle if hurried. Thymic area much

shrunk at top and on the right. Also reported as civil, helpful in the ward, without suggestion of degeneracy or defect. Wt. 73 lbs. Now in 6A grade. Sent back to school.

Case 20.—Boy of 5 years. June, 1914. American stock. Has been no other child. Mother very "nervous."

First tooth at seven months. Nearly two years old when he began to talk. Has always talked very rapidly. Stammered in spring of 1913; then it let up; again stammers "the last few days." Came, however, at first chiefly for his nervous and mental condition.

Tonsils and adenoids removed last spring. "Never had a cold until last winter"; but has long been subject to coughs and given cod liver oil.

Sleeps 10½ hours, now quietly. No enuresis. Mouth-breather in part, and at times on back.

Is hard to discipline. Requires constant entertainment. "He is never still." Keeps up a steady moving about. "Talks all the time."

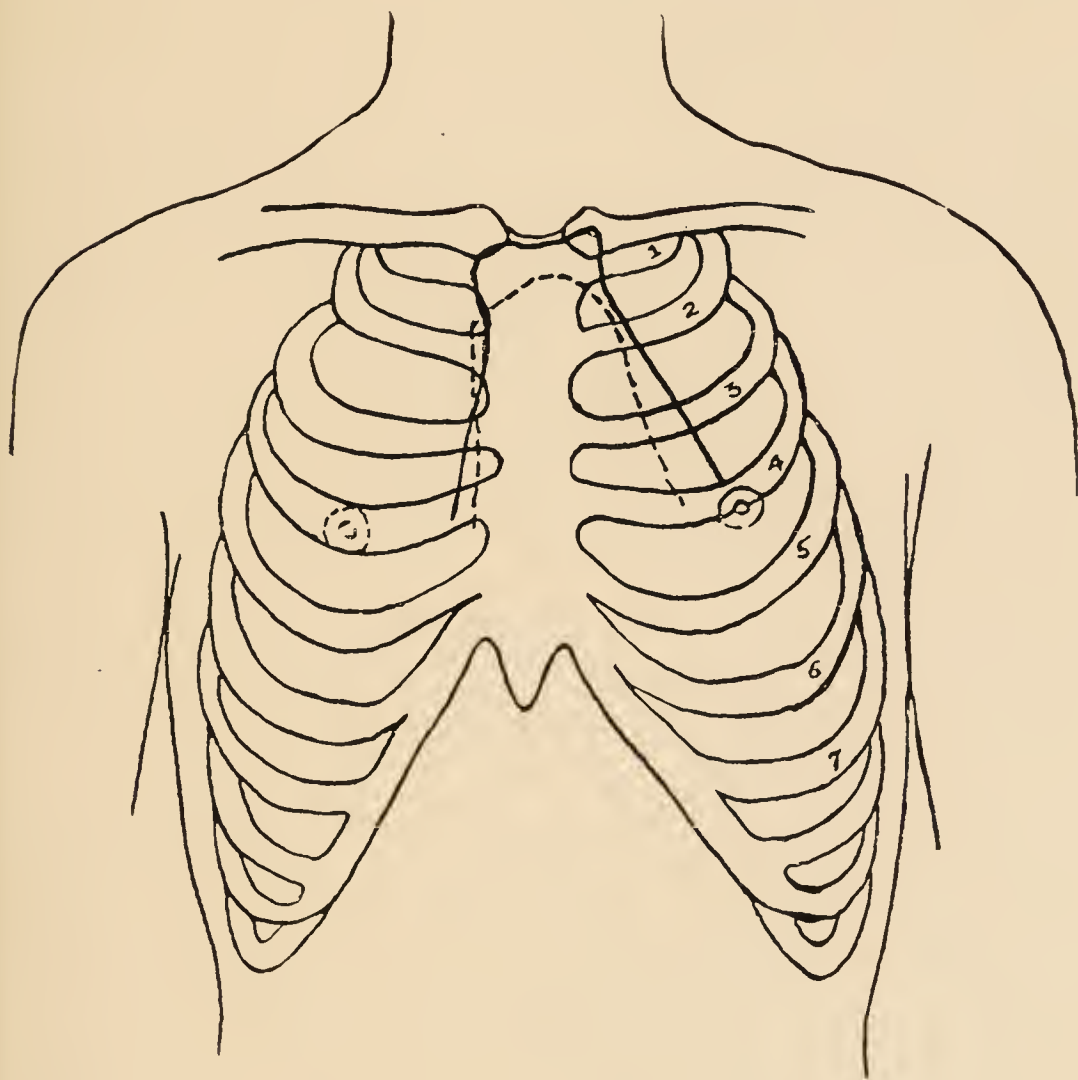
Very fair complexion; soft, delicate, translucent skin, freckling easily. Always pale. Hands chap.

Good height. Small winging scapulæ, and diastasis. Very hypotonic elbows and hands. Nose retroussé. Fine, short teeth, slanting in. Head max. 50, 2 cm. C. I. 78, 5. Thymic dulness (at this time a trifle low compared with that of bad stammerers). Some thymic veins.

Spent summer on a farm, with subsidence of stammer and general improvement. On returning to town and attending kindergarten he promptly developed "a cold" that kept up until he stopped school early in December.

Has always been a very hearty eater, besides taking a quart of milk a day. Grown two inches taller during the summer. Now (October 22), Ht. 45¾ ins. Wt. 41 lbs. Head 51, 5. Two new lower incisors.

First mitral a blur if not a distinct murmur. Gracile, long, thin neck. Scanty chin. Many large cervicals. Thyroid small. Thymic dulness now ample and well defined. A fulness at manubrium. Impatient, uneasy,



CASE 20.

flighty manner. Moderate return of the stammer. December 5, Ht. $46\frac{1}{4}$ ins. Blinking.

In December and part of January he suffered from an attack of general chorea. On recovering from this his speech was worse, "stumbling" and stammering much. Noted by the father, a teacher, that he frequently repeated the initial letter of words, as w, h, l, b, ky, t, i, f, th. No increase in weight in three months. Thymic dulness

now large (charted). Manubrial angle. A definite murmur at apex. Systolic under 90 mm. Splenic dulness 9, 5. So sensitive, fearful, timid and fussy that by no plan could he be persuaded to submit to X-ray treatment, the attempt increasing his stammer for a time.

February 20.—Stammer recently worse; apparently from upset stomach. Hence limitation of diet. The T., whenever taken, ranged from 99.2 to 99.8 degrees. Some torus ridge of palate. Costal knobbing and even tenderness, more on right; slight Harrison groove; some depression of lower sternum. Heavy pout to abdomen and lumbar incurve. Squeaky, high, childish voice. Lower teeth irregular. Dry, slightly exfoliating skin over dorsum of hands and forearms, down back, and on legs; more thickened in front of knees (the condition termed xerodermia).

March 6.—“Improving in all respects.” But occasional stammer; manner quiet. Thymus much reduced (as shown by the sketch).

Case 21.—Girl 4½ years. August, 1914, per Dr. Gingo. One younger sister living; an older died. Hebrew. Trouble is stammering, and now frequent urination. Stopped nocturnal enuresis at 20 to 24 months.

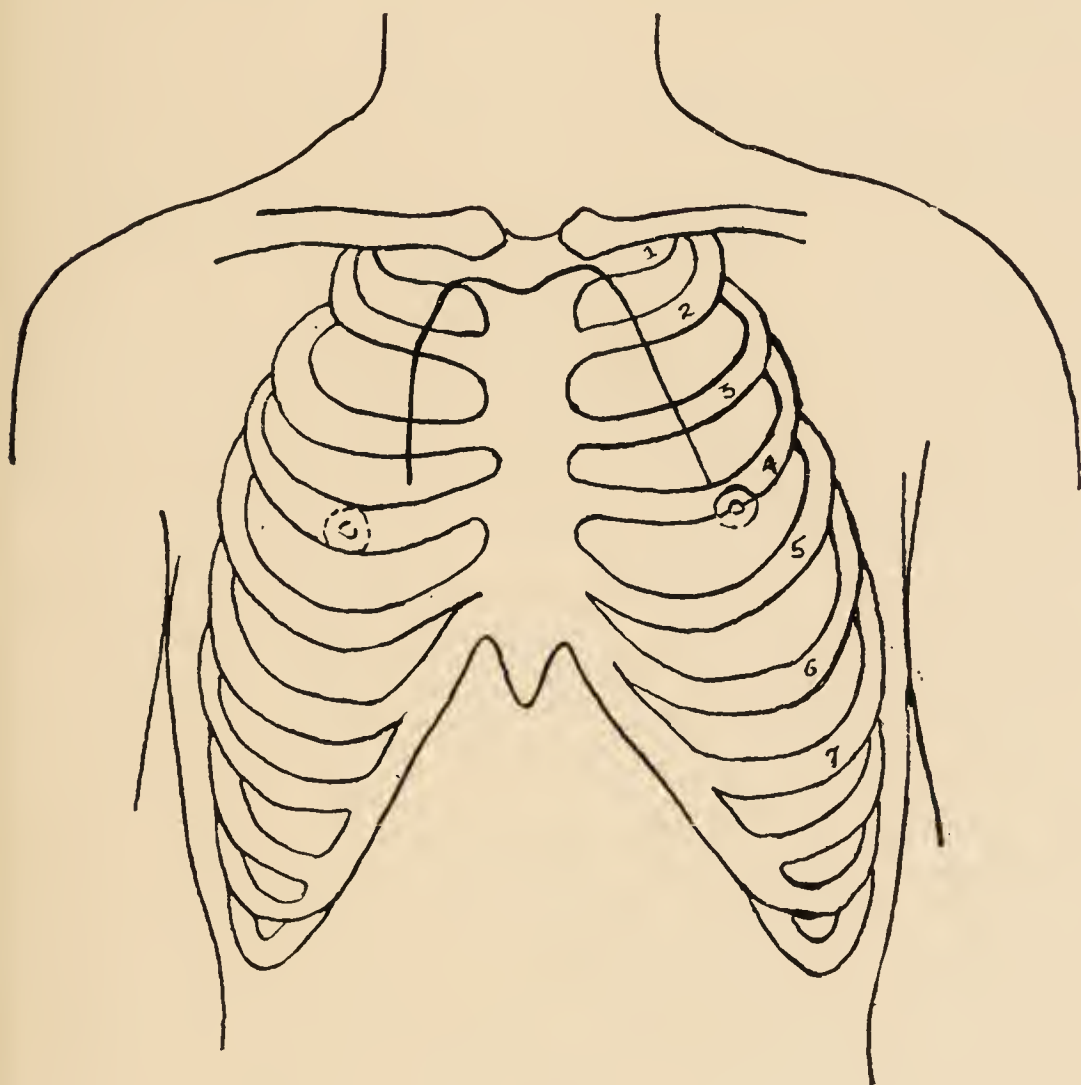
A period of stammering for 10 to 14 days in early spring of 1913, that subsided of itself. A male cousin of the mother is the nearest relative that stammers. Now some seven weeks stammering again; better off and on; when once started to stammer she keeps it up.

Always been a large child, and now growing much faster. “She eats pretty well,” least for breakfast. At times “peevish,” wont answer, and is thought to be timid. “Sometimes passionate, rubs one leg against the other.” Perspires some.

Sleeps soundly (up once to urinate) some 9 hours, plus

a day nap. Mouth open "as a rule." Tired and a headache in the morning.

Is a bouncing girl, about 5 years by size. Wt. $52\frac{1}{4}$ lbs. P. variable, about 80. Tension low. Sounds clear; accentuated second a. and p. Sighs some.



CASE 21.

Ample thymic dulness; slight manubrial fulness and veins.

Teeth badly decayed, mostly but roots. Thyroid small. One or more lymphatics on right of neck. Head 50, 0 cm. C. I. 78, 5.

Dr. Gingold reports her as improved when last seen a few weeks later.

Case 22.—Girl 5 years. L. I. C. Hosp., December, 1914. Irish parentage. Is fifth of six children (five living). Mother of spare habit. Non-instrumental delivery; duration about five hours.

A diarrhœa the first summer. Started to walk at 13 or 14 months. Teeth came young. Talked as early as the others.

"She sleeps all during the night," but is up twice to urinate, and often by day. Enuresis up to $3\frac{1}{2}$ years of age. "Nearly all the time has her mouth open; in sleep too" (nurse).

"Very easily she gets a cold"; a slight one a month ago with croupy cough at night. No history of adenoids or tonsils. Many large cervicals. Max. head 49, 5 (incl. some hair). C. I. 79, 3. Faint in-cast of right eye. Left pupil a trace the wider.

"Not afraid of the dark" nor timid. "Used to be very restless," not lately. Never to school.

"She is a big eater." Considerable thirst. Ht. 41 ins. Wt. $39\frac{3}{4}$ lbs.

Bow legs noticed two years ago, still evident. Wore braces then a month therefor. Harrison's groove across lower costal border, and lower end of sternum dented in.

Diastasis and moderate winging of scapulæ. A pronounced finger-sucker. Some lumbar incurve. Much abdominal pout.

Slight ichthyosis of face and body. Thyroid seems scanty. Face cretinoid (breadth, flat nose, etc.).

P. 100 mostly, at times down to 80. Cardiac sounds nominally clear. But the heart action is pounding, and there is a roughening of the first mitral.

Marked thymic dulness, though perhaps not quite as high as in some stammerers.

She was brought in by the ambulance, on December 5,

for an epileptic seizure. Has had four or five the last two years; the first one a month after putting braces on (of course attributed to the braces and hence the same discarded). The attacks begin in left arm, eye and leg, eyes looking to the left. Vomiting and even bowel movement early in attack. T., at first 100, inclined to the subnormal three days later.

Hesitancy, delay and some stammer in speech; also moderate lisping. The nurse reports that she "stammers quite a little" if excited or talking quickly. The stammer may not be noticeable in quiet, short replies.

The above noted thymic dulness was found a couple of days after admission. But when it was sought to make a chart (January 4, 1915), only a faint tongue, up the middle of the thymus, could be traced. Hence no sketch of the dulness is presented. Had been under treatment, and no recurrence of seizure. No stammer could now be detected by interne, nurse or myself.

This was clearly one of the cases of epileptic stammer (*v. infra*, pp. 271-272), where the stammer only occurs in sequence on a seizure, subsiding in the interval. The mother was unaware of the stammer, as the child was each time taken to the hospital and recovered full speech before returning home. Instructive also is the coincident swell and ebb of the thymus.

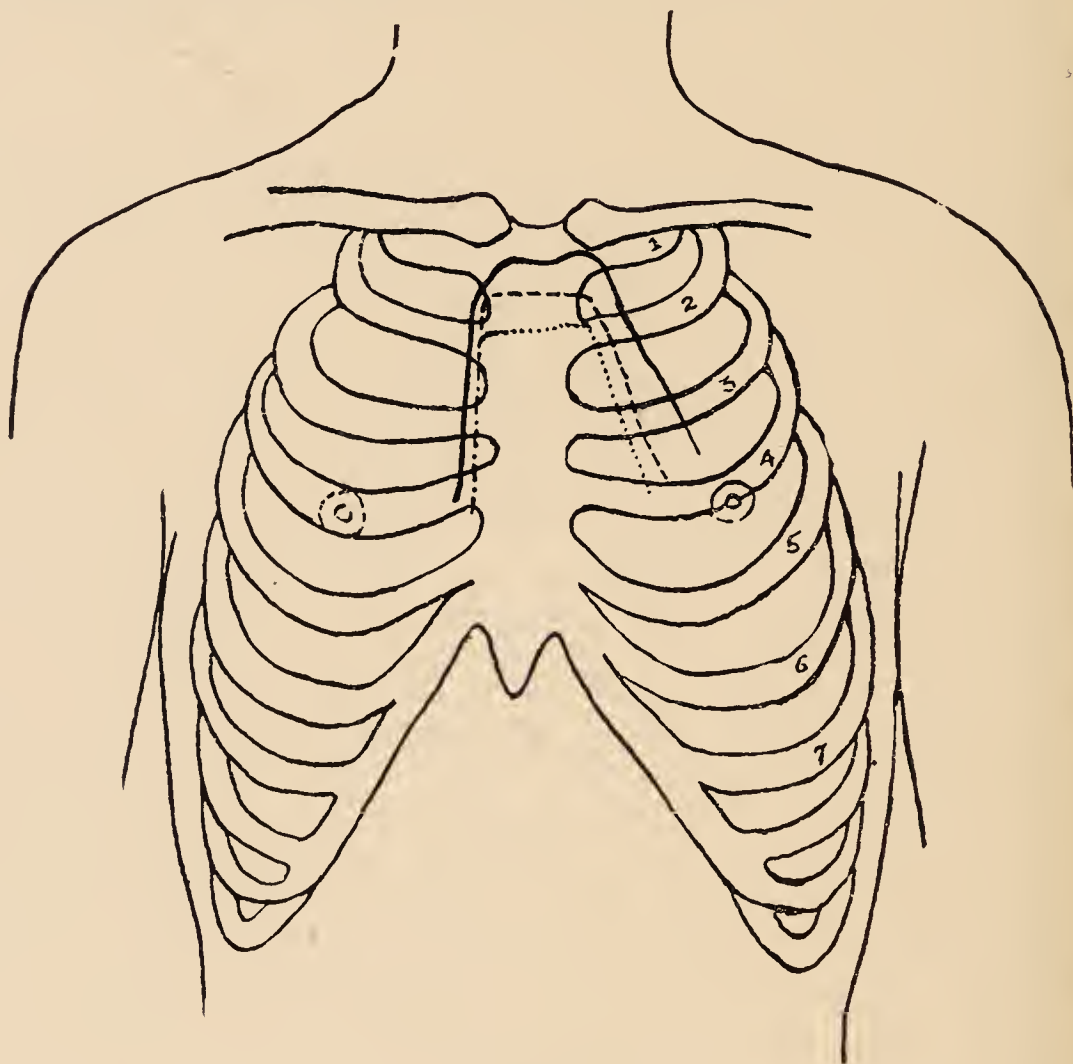
Case 23.—Man of 65 years. American. Admitted November, 1914, to K. C. Hospital. "Bound out as a boy from 10th to 18th year. Laborer, peddler. One daughter living.

"Ever since I remember, I always stammered. Years ago I stammered worse than I do now."

Apoplexy three years ago; right hemiplegia, now fairly recovered. Increasing deafness. Left pupil small but reacts to light; right large, fixed (cause unknown).

"Always had a good appetite," and ate his "share." Max. wt. 133, two years since. Ht. 62 inches (in slippers). Broad frame.

Scapulæ wing. Moderate stoop of shoulders. Right elbow hypotonic; left not. Is right handed.



CASE 23.

Distinctly prominent abdomen. Plantar arches flat. Not a snorer. Does not know about mouth breathing or past enuresis.

Large winging ears. Both nostrils nearly closed. Some moderately enlarged cervicals on each side. Prominent palatal ridge (torus). Thyroid very scanty. Jaw somewhat small. Max. head 56, 5 cm. C. I. 84, 5.

Cardiacs clear. Systolic 155 (by auscult.).

Large thymic dulness (*v. sketch*). Prominent manubrium, especially at juncture and in comparison with the depressed sternum. Various thymic veins. Harrison's groove.

Urine negative; also blood Wassermann.

Mentally somewhat dull; classed as "senile dementia" in one service. Exceedingly fearful, sensitive, babyish; objects that any little examination, as of nose or ear, hurts him.

The short stature, square head, depressed sternum, grooving of lower ribs, and torus show that in younger years he suffered from some subversion of osseous development, of rachitic type.

Three X-ray treatments of the thymus in December (first on 14th, and last at end of month).

January 15, 1915.—"He doesn't stammer so much" the nurse now reports. Only an occasional hitch or repetition of first syllable. Area of thymic dulness less, now remained stationary a month.

Fourth X-ray, January 25. From this the skin of the area was much reddened and injected. The orderly reports that each X-ray treatment prostrates this patient for three-quarters of an hour, "staggers, feels weak," vision seems dazed, and the patient complains that it knocks him out for a day or more.

February 28.—Thymic dulness further reduced. Stammer not noticeable; a slight hitch under pressure or excitement. Systolic 150. Feels that for the first time in three years he can work some this summer.

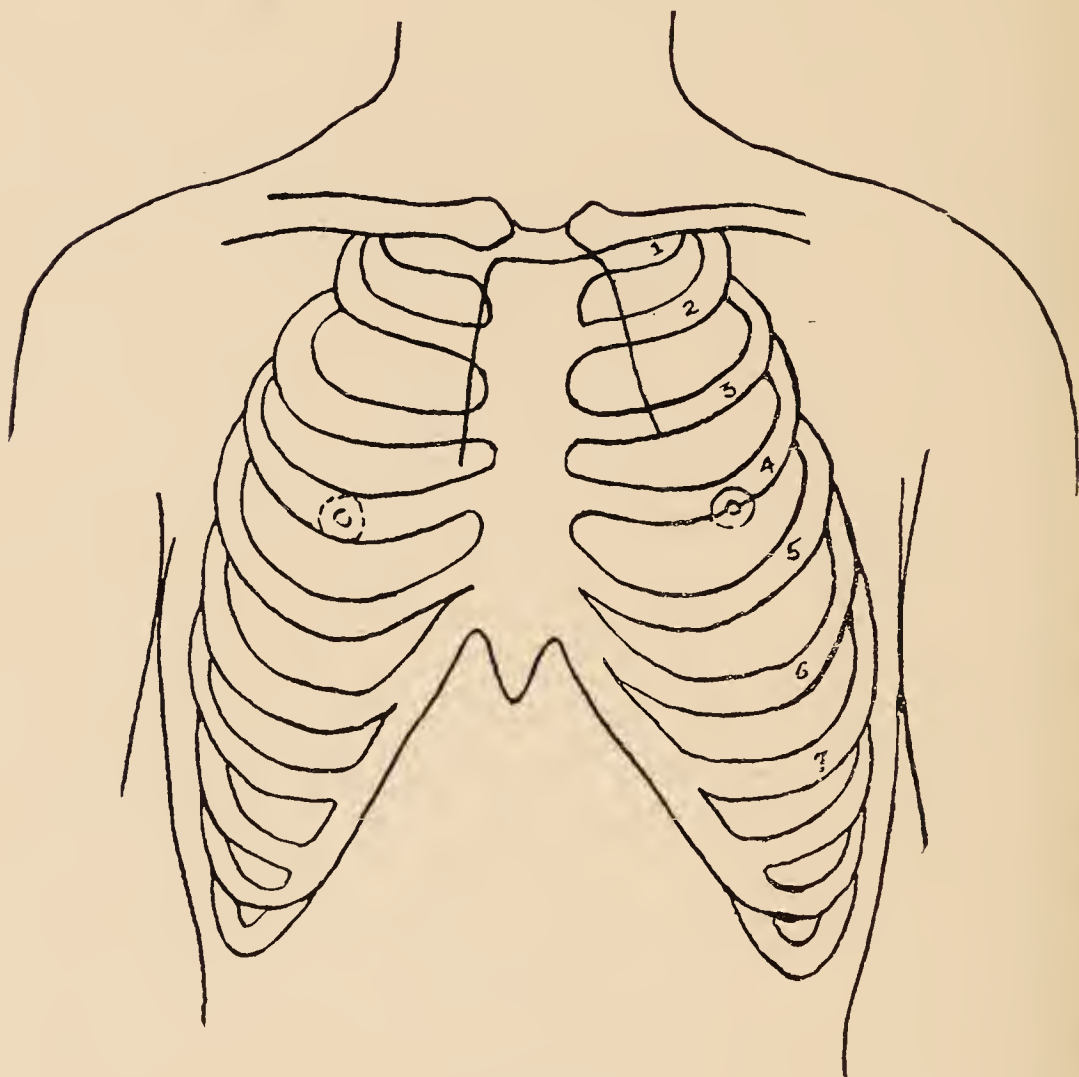
Case 24.—Girl, $11\frac{3}{4}$ years old. January, 1915. Is fourth child; lost a brother and a sister.

"She used to stammer terribly," but not now so badly. This started from a fright at six years; and at the same

time until ten years old she was a great twitcher—those jumps however were only in connection with speaking.

“She is a big eater” most so of the family. Menstruated since 10 years old. “She’s a strong girl.” Never croup.

Gets in a temper at times. Left back three times at school. Now in grade 3B.



CASE 24.

Sleeps well, 11 to 12 hours. Not a snorer or mouth-breather. Wakens fresh, but mouth may be dry.

Large girl. Wt. 109. Ht. 4 ft. 11¾ ins. Is bright, fully as intelligent as her older sister.

Scapulæ wing markedly. No tremor. Numerous white crossmarks on nails. Very hypotonic elbows. Solid

shoulders. Slight lumbar incurving. Considerable abdominal pout.

Tonsils small. Been no tonsillar adenoid or nasal trouble. Teeth fair. Some enlarged cervicals low on each side. Head max. 54, 0. C. I. 76, 0.

P. 94. Systolic 120. Oral T. 99.0 degrees. Cardiacs clear; but a marked accentuation of second p. and a., and visible pulsation of anterior chest wall on left.

Large thymus by dulness, greater on the left. No special precostal veins. Slight fulness of manubrium.

Jumps and jerks musculature of face, neck and shoulders, and somewhat of the trunk each time on starting to speak; this is clearly of the common stammerer's type.

Case 25.—Boy of 10½ years. January, 1915. Irish race. Is a bad stammerer. Next older sister stammers slightly.

A "sore throat" last winter. Eats more than his sister of 13 or brother of 14. Not a perspirer. Is in 2B grade. Sleeps 11 hours. Grinds teeth. Still frequent enuresis.

Very childish in appearance, but bright looking and intelligent. Great delay in getting words started; then at times he may go ahead fairly. While striving to start a word he shows slight pulls, twitches and tremors about the body.

Very soft, translucent skin. Dark complexion. Skin of face slightly scaly and indurated. Fine lanugo-like hair all over body.

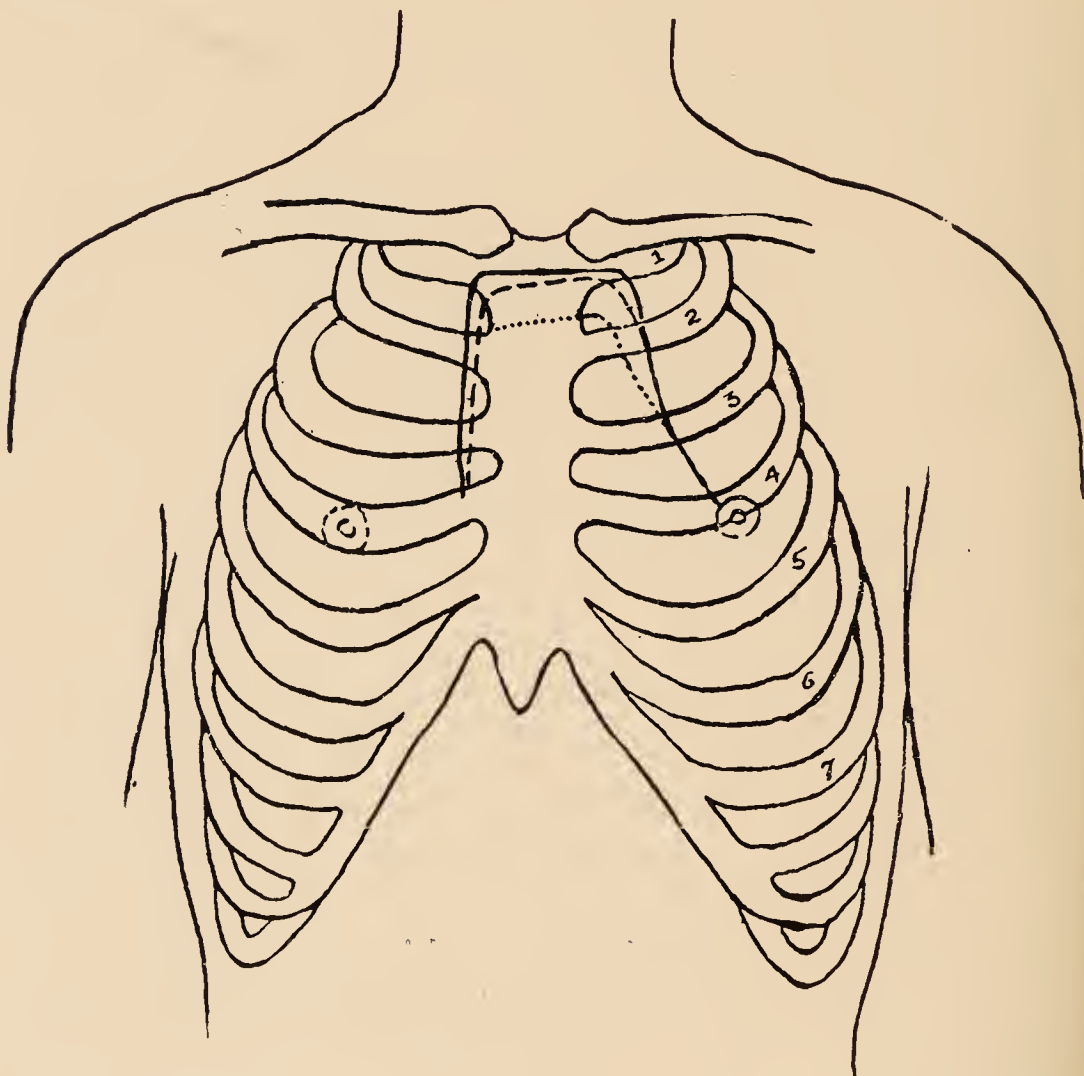
Spare habit. Slim neck. Scanty chin. Numerous large cervicals. Mouth mostly open. Fairly regular teeth. Domed palate. Large eyes. Thyroid not large at isthmus.

Is very sensitive. Cries easily. Sighs persistently.

Hypotonic elbows and hands.—Scapulæ winging. Very pouty abdomen. Somewhat excessive lumbar incurve.

Ht. 54.5 inches. Wt. 58 lbs. Max. circmf. head 53, 4 (thin hair). C. I. 80, 8. Splenic dulness 10 cm. long.

P. about 78, but varies much in rhythm. Systolic 91 mm. First mitral a moderate soft murmur. Coughs and yawns some.



CASE 25.

Large thymic dulness (nearly to top of manubrium). Lower and middle sternum depressed, leaving a broad furrow, with lateral ridges and sunken farther out (degree of pectus carinatum). Prominence of manubrium; and definite angulation. Much veining of front chest-wall, out and down.

First X-ray January 27; and other treatment instituted. Second radiation on February 24.

March 20.—“The speech is much improved.” Now often speaks well. Wt. 62 lbs. Ht. $54\frac{5}{8}$ ins. Further reduction of thymic dulness across the top (see chart).

III. ANALYSIS OF CASES.

In the practical sense there are but two main points: Is the discovered cause real? And is treatment successful? But, as Bluemel says (“Stammering,” etc., 1913): “The true causality must explain *all* the facts.” It is not alone a question of the observation of conditions, but also of the working out of the relations.

It is not necessary here to re-establish the known facts regarding stammering and stammerers; these can be quoted or corroborated in due place. But it is in order to review the findings in the above cases, especially such as have a bearing on the question, see to what explanation they point, indicate briefly how the body of new or known facts harmonize herewith, and how this works out in practice. To this we can now proceed. The known phases of the physical side of the stammerer may suitably be considered first.

FINDINGS IN THE ABOVE CASES.

¶ 1, 2 and 3. *Adenoids, Tonsils, Nasal Obstruction.*—The frequent occurrence of this class of troubles in stammerers has been fully discussed by others. The facts are so well known and have been so elaborately studied, that it is only necessary to present the matter by a few convenient excerpts.

These morbidities are such frequent accompaniments of the trouble as to indicate that there is something back of the stammer, since they cannot well be a sequence of it. Hence, as associated phenomena and as auxiliary causes they have a twofold interest.

Although an exact account of these hypertrophies may

not have been kept in all the cases some note indicating nasopharyngeal block was made in 22* of the 25. Many of the mouth-breathers were included in those with other evidence of block. Three more told of dry mouth at waking. Many of these had been operated one or more times.

Hudson-Makuen (1914), says: "Early in my studies of stammering I became so deeply impressed with the frequency of concomitant nose and throat affections that I thought there must be some etiological relations existing between them, and I have had no reason to change my mind, although I am not quite sure what these relations are. No less than 98 per cent of my stammerers complained of some nose or throat trouble, and so great was it in 36.8 per cent of them that operations were performed for their relief. Over 37 per cent had intranasal pressure, due to various irregularities of the nasal septum, and about 11 per cent of them underwent operations. About 60 per cent had diseased tonsils and adenoids, and operations were performed on nearly half of them." "Whether it is the catarrhal conditions which cause the stammering, or whether the stammering causes the catarrhal conditions." He also speaks of the "irritability of the pharynx" (1913).

Gutzmann found excessive adenoids three times as frequent among stammerers as among normal school children, and considers them an important secondary cause—adenoids in 33 per cent of his cases; diseases of the respiratory tract in 70 to 80 per cent; and infectious diseases fol-

* Adenoids—Cases. Nos. 2, 3, 5, 7, 10, 11, 13, 14, 20.

Tonsils—Nos. 2, 7, 11, 13, 18, 20.

Nasal Block—Nos. 5, 6 (also a snuffler), 4 and 17 (on one side in each), Nos. 1, 3, 8, 19, 23.

Depressed Nose—Nos. 1, 6, 9, 20.

Very Narrow Small Pharynx—No. 5.

Mouth Breathers or Dry at Waking—Nos. 2, 4, 6, 7, 8, 10, 11, 14, 18, 19, 20, 21, 22, 24, 25.

lowed by stammering at times. Nadoleczny, however (*Münch. Med. Wochenschr*, 1910, p. 132), while mentioning that Arslan, Bloch, Gradenigo, Gutzmann and others have seen stuttering cured by adenotomy, points out limits to the recognition of pharyngo-adenoplasia as a cause of stammering.

Removal of these causes, though mildly beneficial, does not usually prove to be a radical cure of the stammer.

Adenoids and tonsils are at least as frequent in girls as in boys. This is shown by the experience of the otologist (personal communication of Dr. W. C. Braislin, of Brooklyn), and by the statistics of Dr. H. Arrowsmith, of Brooklyn (*N. York M. J.*, 1897, Aug. 28). This fact also argues strongly against them as specific causes of stammering.

Adenoids and tonsils are classed as lymphoid tissue, and their hyperplasia constitutes direct evidence of a state of lymphatism.

The relief of such pronounced manifestations as these (§ 1, 2 and 3), and the re-establishment of nasal respiration which such relief permits, each must have a favorable influence on respiratory disorders of any origin. Mechanical or functional interference or reflex disturbance in any other part of the air-passages must necessarily be benefitted by removal of naso-pharyngeal obstruction. This harmonizes perfectly with the thymic interpretation of stammering, and affords a rational explanation of the effects of removal of these growths; we can see why commonly benefit and occasionally cure results.

§ 4. *Mouth Breathing*.—This can be largely attributed to mechanical interference with naso-pharyngeal respiration (conformable to the findings just mentioned under § 1, 2 and 3). But this does not always prove an adequate explanation. "Bloch, in his monograph on the pathology

and therapy of mouth-breathing, showed that the latter plays etiologically and pathogenetically a role in stammering'' (Nadoleczny). Nor does removal of the said obstructions always if even generally cure the mouth habit.

In connection with this feature may be recalled Diefenbach's operation (1841) of cutting a wedge-shaped section out of the root of the tongue, as a remedy for stammers.

Sleeping on the back (Nos. 2, 4, 5, 8, 18, 20) greatly favors the practice of nocturnal mouth-breathing; while snoring and dry mouth at waking are its sequels. Restlessness in sleep may be similarly secondary to obstruction in respiration (evidently so in all cases where restlessness jumps or talk was noted, Nos. 1, 2, 3, 4, 5, 6, 10, 17, 25).

¶ 5. *Enuresis Nocturna*.—Enuresis is merely one of the symptoms often associated with stammering, member of the same group or complex of symptoms, and not in itself of etiological significance to the stammerer, except in so far as it may tend to increase the feeling of chagrin and sensitiveness.

That the stammerer is also over-frequently a bed-wetter beyond the age of infancy, proves to have been noted in the past (*e. g.*, by Gutzmann, 1898). It is the persistence or recurrence of this habit beyond the usual period (not its permanency) that has significance; in infancy it is natural enough.

Enuresis, beyond the common period in youth, was stated in twelve cases (Nos. 1, 2, 3, 5, 7, 8, 10, 11, 12, 13, 22, 25); denied in six (Nos. 9, 14, 17, 18, 19, 20); not noted or unknown in six (Nos. 4, 6, 15, 16, 23, 24). In two (Nos. 21, 22, both young girls) the habit was to get up at night to urinate. It can consequently be concluded that over one-half the cases of stammering give evidence of a degree of abnormality in this respect. This is so dis-

tinctly in excess of its occurrence in normal or average children (really normal in none after a certain age), that some relation to the stammer seems certain.

From the figures given below,* though on this point small for conclusions, it would appear that in the younger years, the nearer this occurrence dates back to the normal, there are quite as many affected girls as boys. But as the child becomes older and hence the trouble more distinctly pathological, there is an increasing preponderance of males. If the ratio of incidence in the sexes were the reverse, it would be natural to assign anatomic reasons (*i. e.*, the easier discharge from the female bladder) for any preponderance in that sex. That the excess in later youth is in the male makes the contrast all the greater. This shows a sex preference in the same direction as stammering, and serves to further identify the enuresis often occurring in stammerers as a part of their symptomatology. The inconstancy of the association and the chronological difference in the course of the two suffice, however, to show that they are not quite the same order of phenomena. It is certain from other cases that non-stammering "wetters" do not always show evidence of large thymus.

* C. W. Townsend (*Arch. Pediat.*, 1887, iv, 844), found that this habit rarely ceases before the ninth month, that the majority of normal infants stop it under 1½ years of age, and that "the limit of normal incontinence" was 3 years. Of his "179 boys and 176 girls, taken at random" from "the lower and lower middle classes," there were 77 incontinents (21½ per cent) beyond three years of age, of which 42 were boys and 35 girls. He quotes Morris to the effect "that in some boys' reformatories one boy in twenty wets his bed."

Dr. Roger Durham, from his service at the Brooklyn Industrial Home, kindly furnishes the following statistics: Of 56 inmates (35 boys and 21 girls), from two and a half to six years of age, 10 were wetters (5 boys and 5 girls). Of 140 inmates (71 boys and 69 girls), from six to ten years of age, there were also 10 cases (6 being boys and 4 girls). Of 188 inmates (110 boys and 78 girls), over ten years old (ten to sixteen years), there were but three cases, all in boys. His totals give an average of 6 to the 100, thus agreeing closely with Morris' figures. Durham's figures were based on actual cases at the time of observation, which may explain the smaller percentage than found by Townsend, though slightly offset by the fact that all above two and a half years were included instead of only those above three years. Taking Durham's totals, the relative frequency in boys and girls is almost the same as found by Townsend.

Two cases (Nos. 3, 13), that happened to be still subject to the wetting habit, were promptly relieved by X-ray treatment of the thymus; and a third (No. 7) was also relieved until the thymus recurred.

With enuresis as with stammering, to attribute it to stupidity or simple carelessness of habit is merely begging the question of cause. That discipline stirs some to overcome the habit is no proof. Nor is its frequency in the present series accounted for by the few cases of mental lack, even assuming that stupidity is in itself a sufficient explanation of the act.

Enuresis is known frequently to accompany nasopharyngeal interference and mouth-breathing. Whatever the cause the child does presently succeed in controlling it. By analogy, if nasal block can be a cause of enuresis, then thymic block might act in the same manner. But, while the relief of adenoids and tonsils may be of advantage in these cases, it is as little of cure-all for bed-wetting as it is for stammers. This indicates that nasopharyngeal obstructions are merely associated or partial causes and not the primary etiological factor in either trouble.

Townsend's statement (1887) that enuresis "is apt to recur in slight acute diseases, especially colds," is in very suggestive agreement with the statement from Gutzmann, quoted above, regarding stammering.

That there is harmony in another direction is shown by the remark of Adler (*Sajous' Cycloped.*): "In a number of cases enuresis may be a local manifestation of a general lack of tone of the entire muscular system (*v. infra*, ¶ 9).

¶ 6. *Enlarged Lymphatic Glands.*—It is chiefly the cervical glands that were examined. These were found palpably enlarged in 22 of the 25 cases (Nos. 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 22,

23, 24, 25). In two others there was one or more large mid-cervicals on the right (Nos. 6, 21, both females). In No. 21 no record was made. It is evident that this can be considered as practically a constant condition in all subjects of this disorder.

In childhood these glands are, of course, more readily palpated. They are so common at that age (though hardly to the same degree) that, considered by themselves, they might not be significant. But, taken in connection with the other evidence, the fact that they have so uniformly been found of some size serves to complete the picture.

In part they might be secondary to the lymphoid hyperplasia inside the throat. But as they are so generally and in most cases evenly affected, the condition may better be attributed to the systemic state. Moreover these nodes are as evident in cases that have been operated for some time or that show but little signs in the throat as they are in the others. Of course, any case with hereditary luetic taint is entitled to large lymphatics, but that would not account for many.

Other lymphatic glands as well as the spleen and testicles have not been followed sufficiently to offer much corroboration from that side. In seven cases in which the splenic dulness was noted it was found to be large in five (Nos. 1, 2, 19, 20, 25); not so in two (Nos. 3, 11). Information, however, volunteered in No. 3 that his sexual organs were entirely undeveloped (began to progress some in 1914-15).

¶ 7. *Temperature*.—A rise of body temperature in these cases may be due to any one or more of so many possible causes (a "cold," tonsillitis, pharyngitis, rhinitis, bronchitis, touches of rheumatism, cardiac processes, tubercular glands, etc.) that it is difficult to find records

showing more than their general tendency to febrile rise. Such rise is sometimes continuous (as in No. 20), but is not invariably present, and it may suffice to note this inclination to increase of temperature during the earlier or more acute stages. It is for that matter well known that children with these throat conditions develop fever on slight provocation, and that the modern relief of adenoids and tonsils has materially reduced the calls of pediatric practice.

A near analogue is furnished by "conditions of hyperthyroidism, for example, in which tendencies to rise in temperature are not at all unusual" (*J. Am. M. Assn.*, 1914, lxii, p. 303).

¶ 8. *Muscular Instability*.—The items under this head harmonize with previous knowledge of the subject. They are, however, doubly interesting, first because of their contrast with the hypotonicity described in the next section, and then chiefly as showing the wide range of muscular participation in many stammerers.

Several classes of movements here are distinguishable:

Various grimaces, spasms, struggles, etc., are common in stammerers when endeavoring to enunciate. Such are largely about the head or in muscles supplied by the cranial nerves. They may, however, reach further, as Levine well says, "In severe attacks of stuttering not only do the lips move, but also the head, the jaws, the eyes, the nostrils, the arms and the legs in a frantic endeavor to produce the desired sound." These movements may be considered but the expression of irradiated impulses common enough where there is block in the transit to muscular action; they pertain to the speech-effort, and not to the phase that is here of especial interest, *i. e.*, interval manifestations.

There may also be much nocturnal uneasiness and throwing about in bed, or a general restlessness and over-activity by day, which are more or less attributable to respiratory interference in the upper air-tracts.

But besides all the above there may frequently be noticed, in the intervals when not essaying speech, a variety of tremors, mild tics, twitchings, uneasiness, contortions, starts, jiggles, gestures, blinkings, habit spasms, choreiform movements, and even real chorea. The last may appear as a brief attack (Nos. 13, 20) or as a great exacerbation of the general motation. Nail biting and finger or knuckle sucking, when persisted in, has a certain relation to uneasiness and can be ranged here.

Such a state of spasmophilia * seems to be a co-ordinate manifestation of the underlying condition, closely duplicating interval phenomena in epilepsy (*v.* also Bonnet, "Etude critique sur la parenté morbide du bégaiement avec les tics et les crampes fonctionelles," 1906). Kenyon, speaking of stammering, says (*Med. Rec.*, 1906, xxxix, p. 969) "that habitual strong spasms make the cure more difficult."

This motor instability may be so marked as to take on an epileptic character, and thus become for a while very puzzling (as in No. 22). The combination of stammer and epilepsy has been discussed by Clark (1900),

* Statistics of Motor Instabilities.

A. Epilepsy—Nos. 5, 8, 24.

B. Choreic Episodes—Nos. 13, 20.

C. Blinking—Nos. 5, 8, 19, 20.

D. Tremor—Nos. 2, 3, 5, 8, 10, 18.

E. Grimaces, Starts, Twists at Speaking—Nos. 1, 6, 19, 24, 25.

F. Motation, Restlessness, Irregular Movements—Nos. 1, 2, 3, 6, 7, 9, 10, 12, 20, 22.

G. Nail Biters, Finger Suckers—Nos. 2, 7, 8, 10, 17, 22.

H. Spastic—Nos. 12, 14 (each slight), 22.

This makes a total of at least sixteen cases showing this mark, in part aside from speaking.

The spasticity in three cases probably had no relation to the stammer. The deep reflexes in this series, however, have not been followed regularly. An active bilateral jaw jerk was noted a number of times, though absent in others. And Fremel (1913) found the facial phenomenon present on both side in 43 per cent of 127 stammerers.

and more recently by Féré ("Le bégaiement épileptique." *Belg. Med.*, 1905, xii, p. 351). The stammer may precede, substitute, or follow the epileptic seizure or be accentuated by it. In other words, the accession of a seizure brings out or re-enforces the stammer. It is easy to see that epileptic attacks, by their strain on the circulation (compulsory stasis at the time and subsequent exhaustion), favor a temporary swelling of structures in the thymic area even provoking the speech-difficulty in near-stammerers—the whole to subside with recovery from the seizure.

No trace of stammer was observed in the few cases of thyroid epilepsy reported by the writer (*J. Nerv. and Ment. Dis.*, 1902).

¶ 9. *Hypotonia*.—Hypotonicity of the general musculature, notably that of the trunk, is one of the most constant and yet least recognized of the concomitants of stammering; it is apparently an integral part of the stammerer's make-up. In some degree it has never been found absent when examined for in youthful stammerers, and is usually present to an extent that makes it readily recognizable.

Not altogether uniform conditions are designated by the various tonias. The phenomena here intended can, however, be conveniently put under one heading; whether hypotonic, atonic or not exactly identical, they are all at least closely connected and similar and evidently rest on the same constitutional basis.

It is the resultant poise of the body as a whole that is the element of chief moment here. The normal S-curve of the body (in profile) becomes greatly emphasized in the typical subject. It is exhibited in various ways, most of them easy to determine. The combination was mentioned by the writer in the 1910-11 paper as: "Wing-

ing scapulæ, pouting abdomen (upper and middle thirds), bad chest forms (as a backward curving of upper dorsal spine, and narrowing antero-posteriorly of upper chest.)”

Indications of something of the kind are noticeable often enough in other children, though not with the regularity nor usually to the degree that is so common in stammerers. And it may be added that the drills, as practiced in some modern schools and described by some of these patients, not only fail to correct this tendency but at times actually favor it. Even if every child showed this hypotonic slouch, it would from the present point of view in nowise diminish it as a bad feature in development.

Some of the more important constituent parts* of this undesirable bodily carriage can be singled out for brief consideration.

The examination should be made with the patient standing, the arms down, and in the natural attitude when idle.

Doubtless associated with this characteristic is the fact that (despite their great tendency to activity) easily tiring, droopiness, yawning, etc., were specially noted in nine cases.

Possibly the condition since described under the term scaphoid scapulæ by Graves may have some relation to that here intended. He attributes his cases largely,

* Hypotonicity (statistics).

A. Winging Scapulæ—Nos. 1, 2, 3, 4, 6, 8, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 22, 23, 24, 25.

Not Winging—No. 12 (man of 41 years, with increased reflexes).

No Note Hereon—Nos. 5, 7, 9 (child of two years), 21.

Also Diastasis of Scapulæ In—Nos. 6, 13, 15, 20, 22.

B. Elbows Hypotonic—Nos. 3, 6, 8, 10, 11, 13, 14, 18, 19, 20, 23 (on right only; an adult), 24, 25.

Hands (Wrists and Fingers)—Nos. 6, 8, 10, 14, 18, 19, 20, 25.

C. Hump-Shoulders (Stoop)—Nos. 2, 3, 23, 25.

D. Lumbar In-curve Excessive—Nos. 3, 6, 11, 14, 18, 19, 20, 22, 24, 25.

E. Abdominal Pout—Nos. 1, 3, 8, 11, 14, 18, 19, 20, 22, 23, 24, 25, (incl. thus all the stoops).

F. Tire, no Endurance, etc.—Nos. 1, 3, 4, 8, 11, 14, 21.

Heavy Lids—Nos. 6, 7. Yawning or Sighing—Nos. 7, 10, 11, 25.

though not exclusively, to lues. Syphilis has also been a recognized factor in numerous cases of thymic trouble (Chiari, Simmonds, Vacher, Ribbert); it was evident in No. 13 of the present series, and may have existed in more.

Projecting Scapulæ, Backward Shoulders.—Winging shoulder blades are a prominent feature in cases of this kind, though of course in variable degree. The condition is readily detected by passing the observer's hand lightly across the back of the shoulders, no disrobing unless of top-garments being necessary for its casual recognition. The scapulæ will be noticed to stand out from the chest wall at their free border. This usually exists to a degree that permits the examiner's finger-tips to catch under the median and lower edges of the blades. Correct posture demands that these structures lie flat against the ribs.

In principle it is not so much a stoop or relaxation as it is a general backward displacement of the whole shoulders. This naturally tends to lift the blades away from the chest wall. This backward thrust of the shoulders may be considered present whenever the scapular position is noted, and is the mark of the whole bodily attitude.

Frequently there is instead of or combined with this an increased diastasis of the scapulæ, or a stoop of some type, that in these youthful cases represents much the same thing.

Thin shoulders with the tubercular stoop do not belong in this class; in fact there may be an admirable development volumetrically of the shoulder caps (deltoids, etc., as in Nos. 3, 11, 24). Doubtless the two (lymphatic and tubercular) types might co-exist or combine on occasion.

Lumbar In-curve and Abdominal Pout.—The estimation of these points is somewhat of a relative matter, as they constitute merely accentuations of the normal. Nor has attention been paid to them in more than a few cases. The older and taller the individual the more noticeable do they become. Whether primary, or partly secondary to the shoulder-carriage, they serve to complete the type of figure.

Of recent years much has been said of the enteroptotic habit, the visceral saggings and attendant bad carriage of the body. These things have rarely been traced to other than carelessness, want of training and poor habits. We can here get an insight into underlying and more fundamental causes in this allied group of cases.* In the present series it is not so much a sagging or ptosis as a compensatory pouting favored by lax muscles. Consequently it does not appear (in these young patients, anyway) as a downward displacement, but as a simple bulging or forward pout.

This phase may not be exclusively of hypotonic compensatory origin, but be in part a matter of abdominal load. The excessive eating and occasional drinking habits of these patients (*v. infra*, ¶ 11) may cause some of the abdominal fulness, and in turn, by displacing the line of gravity and by up-pressure on the diaphragm, tend to throw the shoulders farther back and accentuate the malposition.

Even the faulty and soft bone-structure (*v. ¶ 10*) must favor the development of bad bodily carriage.

The girls of this series were hardly of the class recently affecting the so-called debutante slouch, though naturally well qualified therefor.

* In all this class of cases of improper development the correctional methods recommended by even modern medical writers follow too exclusively the old calisthenic school, and fail to apply the principles of growth, that are now matters of common knowledge.

Elbows.—This is merely corroborative of the general character of this condition, and at a place convenient for testing. Extension at the elbow does not normally permit the forearm to quite reach a straight line with the upper arm. Passive extensibility beyond this limit may be classed as showing hypotonus.

This state at the elbow corresponds in principle with the winging of the scapulæ, over-curving of the lumbar region, and consequent abdominal pout—all part of a systemic relaxation or lack of tension in the muscular condition.

Laxity at the elbow is so common in women and even in children as to then have less comparative value if taken by itself.

The hands (wrists and fingers) may also incline to the hypotonic type, though this likewise is common enough in children, and is less accurately determinable.

No attempt was made to establish the existence of an analogous condition in the lower extremities, unless the flat arches in two adults (Nos. 12, 23), as it is not as readily or exactly determinable, and did not appear to be of importance in this connection.

The general effect of the badly carried shoulders and the compensatory or attendant and excessive lumbar and abdominal curvings is to produce a most unhygienic attitude of the body when erect (a hypotonic slouch), and scarcely less so when reclining.

Yet many of these patients or their friends actually pride themselves on their erectness, their “standing straight.” They may in fact make a nominally better appearance in this respect than their brothers or sisters. They have been chided and “jogged” and trained until they have succeeded in bringing the head to balance at about its normal point, leaving the S-shaped body un-

corrected if not exaggerated. As the latter is masked by clothing the false sense of achievement is not dispelled.

Besides the general unhygienic and more or less recognized influence of this attitude of the body, it has another and here more specifically baneful side that will be considered below (*sub* Thymus, ¶ 12). It is this latter effect after all that constitutes the chief pernicious element in the hypotony and its manifestations as regards the stammerer.

Those individuals reaching later life, and who have somewhat conquered their stammer, show less hypotonia than the youthful ones, though some remnant of it is apt to remain.

There was once an idea that the thymus had to do with muscular development. In the present class of cases it seems rather to have to do with the non-development of one quality in muscle, normal tonus. Applicable to this phase is the comment of Upson, that stammering is "adynamic in origin." And it is interesting to note that recently Markeloff (*v. N. York M. J.*, 1914, I, p. 236) from experiments places the thymus amongst the internal glands "which depress muscular action." This agrees with the earlier clinical observation of Lerch (*Med. Rec.*, 1909, I, p. 392) that, "Enteroptosis with nervous symptoms is almost invariably associated with enlarged thymus."

¶ 10. *Abnormalities of Bone Development.*—The proportion of stammerers showing such bone effects of systemic origin proves to be large, especially as the active stage of the defective bone-growth has often passed, and as lighter disturbances of this order may leave scant trace, or in fresh cases the lasting marks may not yet have become patent. Little, if anything, appears to be known regarding this relation.

In many cases the process itself appeared to be no longer active, and therefore could hardly have any direct relation to the stammer. It bears on the question of constitutional tendencies and systemic condition, and leaves a favoring anatomic basis that is only or in part compensated by later growth.

Ordinarily the process is not recognized unless or until it has produced lasting changes. These residua are of various kinds. In the first group there were twelve cases as follows:

In eleven of these (Nos. 3, 7, 8, 11, 14, 18, 19, 20, 22, 23, 25) the front chest wall showed sequels of an early or still active anomaly in nutrition or in the internal secretions, of rachitic type. And the prolonged so-called dysenteric attack in No. 1 suggests that he also was suffering from something of the sort at the time of observation (a history of similar troubles occurred in some others, *v. infra*, ¶ 11). While the permanent effects on the bone are not all apparently the same (usually depression of the body of the sternum, less often the form known as pectus carinatum, Nos. 7, 8, 25, with a transverse sinking-in of the lower front chest, sometimes termed Harrison's groove), they doubtless all follow from a softening and yielding of the growing bone, and result in both some contraction of the anterior mediastinum and an impaired expansion and freedom of the front chest wall. That this must directly affect the respiratory functions and the thymic condition is evident.

Case 11 showed also a lateral curvature in the lower dorsal region. And No. 3 was known to have had knock-knees for years as also No. 22; while No. 18 was moderately bow-legged. There was also one case, No. 13, of marked Hutchinson teeth, with corroborative signs; in a general

sense such specific influence can, of course, act similarly to the rachitic.

To be included here also are the prominence and angulation of the manubrium, mentioned below in connection with the thymus, although other influences may be partly in play in their production.

Diminutive Chin (Retrognathism).—Whether this type of dwarfed or effeminate structure arises wholly from systemic influences or is in part due to local conditions of growth may not be definitely known.

Prognathism was not observed in any case. On the contrary the inclination is towards poor development of the lower mandible and its adjuncts; this was specially noted in Nos. 3, 7, 8, 12, 18, 19, 20, 23, 25, and in lesser degree in others. This chin conformation belongs as much to the sensitive and timid stammerer, as do bumptiousness and aggressiveness to persons with "heavy-hung" jaw. With this often goes the gracile neck. This is the opposite of the prognathic, big-nosed, bull-necked, naturally overbearing type of individual. The popularism, "chinning," is not altogether a misnomer.

Height.—Though the facts collected on this point may not warrant final conclusions, certain important inferences are permissible. The number of cases is limited. Race, family and conditions cannot be allowed for. Comparisons are unequal, as in the young any difference in measure represents a greater relative variation than in the adult. And these cases were measured with shoes on (only slippers in the hospital cases).

The findings are the more striking because of reasons which might well favor a degree of dwarfing: old heart trouble in many; the hypotony and sag-slouch, and the shortening tendency attributed to rachitis. These considerations in part had created the impression, until the

HEIGHT.

Case No.	Sex	Age, Yrs.	Height, Actual inches	Standard Average) inches	Excess inches	Deficiency inches
1	m.	12	55.5	54.5	1.0	
2	m.	10	53.75	50.95	2.8	
3	m.	14	64.625	58.75	5.75	
4	m.	11½	61.375	53.6	7.775	
5	m.	33	68.0	67.5	0.5	
6	f.	20	62.75	64.0—		1.25
7	m.	6½	42.5	43.9		1.4
8	m.	15	66.25	61.45	4.8	
9	m.	2				
10	m.	9⅔	55.625	49.88	5.745	
11	m.	15	65.5+	61.45	4.05+	
12	m.	41	70.75	68.0	2.75	
13	m.	10				
14	m.	4½				
15	f.	13	55.0	57.3		2.3
16	m.	14	58.0	58.75		0.75
17	m.	14½	60.875	60.0	0.875	
18	m.	27	71.625	67.5	4.125	
19	m.	11⅔	53.5	53.9		0.4
20	m.	5½	46.25	41.7	4.55	
21	f.	4½				
22	f.	5	41.0	40.3	0.7	
23	m.	65	62.0	66.5		4.5
24	f.	11¾	59.75	54.4	5.35	
25	m.	10½	54.5	51.9	2.6	
Totals					53.37+	10.6

final computation, that a majority of these patients were undersized. The opposite outcome speaks for a possibly suspected but unknown phase of hyperthymism,—experimentally demanded, but apparently unrealized in practice.

Of the twenty-one cases of which a record of the height was made, six were below standard and fifteen above. This was determined by comparing the individual measures of height with those for the same age and sex as established by the standard averages of Franz Boas (quoted by Stanley Hall in “Adolescence”), and, for American adults, by the actuarial standards worked out in life insurance (the figures for the latter and the methods of correction were kindly furnished by Dr. Z. T. Emery, Medical Director of the Manhattan Life Co.).

Moreover, on balancing the sum of the excesses with that of the deficiencies, there proves to be a total of 42.77 inches on the side of the overgrowth, or an average of two inches to each of the twenty-one cases.

If we deduct the customary one inch for shoes (a majority being young persons for whom three-quarters of an inch proves nearer correct), there still remains an average plus of fully one inch for each one of the 21.

While from these facts we may not conclude with certainty that stammerers average taller than other persons of like age and sex, it at least appears that the various handicaps are not sufficient to reduce their average height below standard. To presume that the rachitic trouble, from which so many of them suffer, differs from the usual infantile form in that it does not stunt growth in height, does not as fully meet the conditions as does the more natural inference that some compensatory influence is at work to increase their growth.

This matter refers only to height, not to weight.

While a few incline to be a little plump (as Nos. 3, 11), a much larger proportion are of spare habit (Nos. 1, 8, 10, 15, 20, 25), and in lesser degree others (as Nos. 7, 16, 17).

The other bone changes noted were of less moment. Abnormal doming of the hard palate with attendant irregularities in the dental alignment is so common an accompaniment of early naso-pharyngeal narrowing or block that its occasional occurrence in the stammerer might be expected (Nos. 2, 3, 4, 8, 11, 18, 19, 25), although even then they may all be part of a systemic state. Some doubt of the importance of palatal arching as a degenerative mark was raised a few years since; it might still be evidence of abnormal bone growth.

Torus palatinus (Nos. 1, 23; moderate in No. 20) is more definite. Slim neck (Nos. 8, 10, 11, 20, 25) is closely analogous to retrognathism. Irregular teeth (Nos. 3, 8, 10, 11, 20), mongol little fingers (Nos. 1, 3, 12, 18), and such minor anatomic stigmata were not recorded with a frequency to give them much standing. Enlarged, "knuckly," small joints (Nos. 8, 18) are typical when they occur. No. 4 also had small, poor teeth; No. 9 was too young for signs to show; strong suggestion of lues in No. 10, as well as in No. 13; teeth gone from decay in No. 21. Most of the others were seen but once, and not examined for bone changes, as their frequency and importance were not recognized until later.

Whether bone changes of general significance occur in each case and are consequently at some stage an essential or invariable part of the stammerer's complex, or only in a large proportion, may still be open to a little question. If we sum up these various deviations from the norm in osseous development, it is certain that conclusive evidence of its early occurrence is present in the great ma-

jority. This evidence from the osseous side, because of its developmental character, permanency in many cases, and visibly organic nature, is in itself conclusive proof, and perhaps the most so of any here offered, of the occurrence of a systemic disturbance in connection with a sufficient proportion of stammerers to show that it is not accidental.

In addition, there is some question whether the hypotonicity and bad bodily carriage above described may not be due in part to the softening and yielding of the supporting skeleton by this early osteoplasia. If so, it but emphasizes the cumulative evidence from this side.

That lymphatism and the thymus have a close relation to the processes of bone growth is widely recognized. "Signs of rickets . . . are often found" in status lymphaticus (Cocks). "In growing bones the changes are those of lessened growth, with abnormal softness and pliability, resembling rachitis" (Meigs' report of Klose's experimental *removal* of the thymus in animals).

¶ 11. *Food Consumption*.—Not all large eaters are stammerers, but children who stammer are big eaters. While these children are not apt to be overstout, in fact, may be the opposite and appear to be in need of nourishment, the histories show that they are large consumers of food, and to an extent that constitutes this a feature of their condition. It was particularly noted in Nos. 1, 3, 5, 6, 7, 8, 11, 12, 13, 14, 18, 19, 20, 21, 22, 23, 24, 25; variably large eater Nos. 9, 10, and for hearty foods only No. 4; making a total of twenty-one out of the twenty-five, with no negative amongst those investigated on this point. This is the more notable as a number showed either conditions or a lack of vigor that might be expected to interfere with appetite.

As children are naturally good eaters and require rela-

tively more than adults, this claim to excess of intake must, in the individual case, be carefully scrutinized before considering the amount abnormal. In many cases this was shown by comparison with other children of the family. The eating habits of youth are not always to be determined by the statements of their seniors alone. A lad burdened with hunger may find it convenient to establish special lines of supply. By getting into his graces or that of his pals, fuller information is sometimes gained. Of course, intercurrent conditions may temporarily dampen the cravings of appetite.

Notable a few times also was the tendency to be large intakers of fluids (Nos. 2, 5, 22). This thirst, however, is likely not analogous to the appetite, but, instead, a secondary effect of the mouth breathing and consequent exsiccation of the throat.

Items in various cases throw some side-light on the food reactions of stammerers: Coated tongue, of course, common; pains in stomach about twice a week (No. 1); vomits at times (No. 3); nervous feeling from stomach (No. 5, probably as part of seizure); abdominal pain and belching (No. 6); vomits at times, epigastric pain (No. 7); pains in stomach off and on (No. 17); gas, and so forth, at times (No. 20); dysenteric episodes (Nos. 1, 4, 14); and one had diarrhoea the first summer (No. 22); rheumatic complaints (Nos. 5, 14); mother rheumatic, asthmatic or a uric-acid subject (Nos. 5, 11); rheumatism of heart in a brother (No. 6); father and his family rheumatic (No. 8); father had sciatica (No. 12).

One ultra-conservative conclusion can be reached with certainty: The stammer, the stammerer's physical condition, and the imperfections of development which he exhibits can in no wise be attributed to scantiness of diet. If either excess or lack of food supply constitutes a

factor, then it must be in the sense of plethora and excess of fare.

But it is evident that this is also a positive mark. The stammerer runs well above the average in appetite and ingestion. And as he rarely grows stout, even on his large rations (*v. supra*, ¶ 10), there must be a craving and a waste of systemic or abnormal origin.

The fact that experimentally thymectomized animals are voracious eaters, and the views of some workers that a thymus permagnus is usually in such condition as to represent a hypothyism, are of interest as affording a possible explanation of the appetite in these cases, and also as showing that the line of questions brought up here is similar to that of thymism in general. The clinical observations in this series, however, were made quite independently of any explanation.

Friedjung (1900, p. 468) tells of the finding by "Fleisch unter den Zeichen der Ueberfütterung an den Leichen der an Laryngospasmus verstorbenen Kinder gewöhnlich eine voluminöse saftige Thymus."—an observation which would appear to tally remarkably with the present findings.

Whether the present cases presented the appearance noted by Rachford in lymphatics, "fat, flabby, anaemic, and markedly lacking in physical development, especially in the lower extremities," can only be answered in certain respects. That there are various lacks in "physical development" has been amply pointed out, and that this applies to the extremities is also true. His cases, however, appear to have been in younger subjects and of greater severity, so that agreement in all details might not occur.

¶ 12. *Thymus*.—Enlargement of this structure or its unusual persistence is a constant abnormality in stam-

merers. There was evidence of this in each of the twenty-five cases. It is the only large sign showing a full 100 per cent (for methods of determining this, see p. 314). The findings in this regard are summarized in the accompanying table. The essential fact is the dulness, the other items being corroborative so far as they go.

As to the specific character of the block in these cases (whether hypertrophy, simple persistence or fibrous enlargement, or how far due to the thymus) only statistics based on the anatomic examination of many cases can give an absolute verification. That is a different order of investigation and is only possible where opportunity offers. Even if it could be shown that a considerable number of these cases had no thymus permagnus, it would not alter the main facts or their essential bearing, but at most, the preferable interpretation.

However, there are certain features that serve to distinguish it and that have been established with definiteness. These include the more or less uniform type of dulness, its preponderance on the left, its subsidence under treatment, and the fairly characteristic associated phenomena. "Thymus dulness is almost constantly much more marked on the left of the sternum than on the right" (Boggs, *Trans. Ass. Am. Phys.*, 1911, xxvi, p. 354). That this peculiarity holds in the present series is evident on inspection of the outline charts accompanying the cases; additional evidence of this is apparent in the greater extension upwards of the left horn of the dulness in all but two (Nos. 6 and 15, both females), and the greater difficulty in some of determining the right upper border, owing apparently to less complete block in that part.

The accompanying corroborative marks of large thymus, indicated in the table, will be discussed later under

PHYSICAL SIGNS OF LARGE THYMUS IN THE 25 CASES.

Case	Age, Yrs.	Sex	Thymus Dulness	Front Chest Veins	Promi- nence (Manu- brium)	Angle at Manu- brium
1	12	m.	present	present		
2	10	m.	"	"	slight	
3	10	m.	"	"	present	
4	11+	m.	"	"		
5	33	m.	"		none	
6	19	f.	"			
7	5+	m.	"	"	present	
8	15	m.	"	faint	slight	present
9	2+	m.	"	present		
10	9+	m.	"	"	present	
11	14	m.	"	"		
12	41	m.	"	"	"	
13	10	m.	"			
14	5—	m.	"	"		
15	13	f.	"			
16	14	m.	"	"		
17	14+	m.	"	"		
18	27	m.	"	"		"
19	11	m.	"	"		"
20	5	m.	"	"	slight	"
21	4+	f.	"	faint	"	
22	5	f.	"			
23	65	m.	"	present	present	"
24	12—	f.	"	none	slight	
25	10+	m.	"	present	present	"

“Physical Signs of the Gland.” The veins were noted in 19 of the 25, compared with 8 of lesser degree in the 20 controls (*v. infra*); and somewhat the same proportion holds for the less frequent prominence and angulation of the manubrium.

The cases of the present series may not belong to the severest form of thymic block—which for that matter is more often fatal while the subject is still young. Cocks, from the Pathological Department at Bellevue, found status lymphaticus 44 times in 1,600 autopsies, a general average of $2\frac{3}{4}$ per cent; and yet that by no means represents the relative frequency of the condition in greater or less degree amongst children in general.

Whether the general condition in these cases be termed thymism (as for convenience is largely done in this article), dysthymization, hyperthymization, thymic block, thymokesis (Lerch, 1909), or something else, is not very material to the present purpose. It appears to have a relation to or be a phase of that variously called lymphatism, thymico-lymphatism, status lymphaticus, status hypoplasticus, lymphatic constitution, etc. Apparently opposite conditions are at times classed under these heads—which may account for some of the confusion. But whether stammering be thus classed or simply as one of the thymic neuroses, or otherwise placed, it agrees in so many ways with lymphatism that it must either be a part of or closely allied to it.*

It is clear that the habitus of these patients, with the projecting scapulæ, shallow chests, and compensatory curve below, tends to throw the thymus and its adnexa abnormally forward against the chest wall, and thus re-

* Instead of attempting a separate comparison at all points with the phenomena of lymphatism and allied states, it seemed better to include in the running text and foot-notes such items hereon as have been met with. They are not intended to be exhaustive but only sufficient to indicate the marked degree of identity.

enforce the area of percutory dulness and the local crowding. That the block, however, is not wholly attributable to this or to casual retraction of pulmonary tissue, but must be due in part to pathologic material at this point, is proven by the general non-occurrence of such evidence in normal individuals, and especially by the effects produced in these cases by the X-ray. The latter often suffices to do away with the dulness at this spot, a result explained by the well-known action of this agent in the dissipation of tissue especially if glandular or pathological, and which the experience of many observers has shown to be accomplishable in the case of large thymus.

¶ 13. *The Circulation.*—Little if any common knowledge appears to exist regarding the heart and circulation in stammerers.

Abnormal cardiac conditions here have a double significance. In the first place they are recognized accompaniments or secondaries of thymism. And secondly, where they are sufficient in degree to permit regurgitation or stasis, they become an etiologic factor of moment.

The heart proves to be so often implicated in subjects of this disorder as to be more than accidental. In such cases the circulation must be regarded as playing an important accessory role in the causation of the stammer.

The venous plexus, frequent on the upper front of the chest, can be classed as secondary. And doubtless most of the functional aberrations of the heart are secondary or part of the general condition, though in turn mildly contributory.

But the considerable proportion of valvular cases indicates that this condition plays a part in the causation. Such leaks must favor intrathoracic stasis and increase local obstruction. A definite bruit, usually mitral, was

noted in twelve cases (*v.* table); while in four others the sounds were such as to suggest slight valvular involvement. About an equal number are thus in the bruit and the free groups of cases, some of the balance showing signs of slight trouble, equivalent to saying that one-half the cases of stammering show cardiac murmurs.

HEART AND CIRCULATION

Case	Age, Yrs.	Sex	Bruit	Blurred	Clear	Systolic Pressure	Other Notes
1	12	m.		mitral		96mm.	intermits. tumultuous.
2	10	m.		mitral		114	
3	10	m.	later	mitral		105 (at 14)	
4	11	m.		mitral		92	intermits constantly. dyspnœa & cough.
5	33	m.			"	120	
6	19	f.			"	135	
7	5	m.	mitral				congenital. variable & intermits.
8	15	m.			"	101	
9	2	m.	mitral				
10	9	m.		mitral		102	
11	14	m.	mitral			120	
12	41	m.			"	112	
13	10	m.	mitral			90	
14	4	m.			"		
15	13	f.	aortic				
16	14	m.	mitral				variable. Thumping, precordial pain.
17	14	m.	mitral			122	
18	27	m.	later	mitral		141	
19	11	m.	mitral			95	
20	5	m.	mitral			90	
21	4	f.			"	low	
22	5	f.			"		variable. rough pounding. old hemi- plegic. chest pulsa- tion. variable rhythm.
23	65	m.			"	155	
24	12	f.			"	120	
25	10	m.	mitral			91	

The question whether these are hæmic murmurs can not be absolutely answered in all cases; many of them are with certainty organic. Anæmia was not specially noticeable in any of the cases; nor from their large eating faculties would anything of the sort be likely. In the few cases where there seemed any occasion for determining it,

the hemoglobin ran 93 per cent, 88 per cent (yet in this case the bruit only became definite as the hemoglobin approached 100 per cent), 98 per cent and 95 per cent. Hence it is hardly in order to attribute these murmurs to anæmia. Moreover, the steady persistence of these sounds for long periods, and even a slight increase occasionally, speak for a valvular origin.

While the cases fifteen or more years of age, six in number, showed no bad leak, one had a mild murmur, and three others some functional disturbance in the circulation.

That lymphatics in general are specially subject to circulatory troubles is well known. Cardiac irregularities, degenerations, defects, etc., are common in thymics. And as stated by Ohlmacher (*Buck's Reference Handbook*): "The aorta, at times the general system of arteries, and rarely the heart, are smaller than the same structures in normal individuals." Hedinger treats at length of cardiovascular troubles in lymphatism. "The general lymphatic hyperplasia (in status lymphaticus) has been found associated with rachitis and with hypoplasia of the heart and aorta" (Witherstine, 1901).

Vasotonus.—A degree of agreement between vasomotor and general muscular tonus is observable in some conditions. The systolic pressure gives a ready method of estimating this quality on the arterial side.

A parallelism of this kind is to a limited extent observable in some of the present cases. The tendency, at any rate in the early course, is not toward high arterial tension.

Some ex-stammerers, past middle life, show a high systolic pressure. This might result from long over-eating, or over-compensation, or be due to the handicap to free respiration and the consequent lessened oxidation, or to

the thymism or other cause. At any rate there is no indication of this in the early stammering period.

Worth recalling here is the conclusion of Wiesel and Hedinger that there is a hypoplasia of the chromaffin system in status lymphaticus, a constant relation of opposition between the thymic apparatus and the chromaffin system. And Parosot (Soc. de biol., 1908, No. 15, *v. Centralbl.*) has shown by experiments on rabbits that thymus extract reduces arterial pressure. Soehle also produced a fall in blood pressure by injecting aqueous extract of thymus. Likewise Swale Vincent, though he interpreted it as only what ensues from any tissue extract. Hornowski (1912) makes the thymus exert a restraining or inhibitory influence on the sympathetic system.

¶ 14. *Bronchitis, Pulmonary Congestion, Etc.*—The recurring upsets by colds, bronchitis, and the like, that play a considerable role in these cases, rarely appear in the histories; to bring this side out clearly requires a more consecutive following up of cases than has often been possible with these, and as their importance is sufficiently understood, this was not necessary.

Some disturbance of this order was noted in several of the cases. If all those with intercurrent symptoms of the kind were counted, the number would be greater. On the other hand if cardiac and tubercular cases were deducted, this type of complication would be less in evidence. Still the bad habitus, tendency to slight febrile states, mouth breathing, as well as the cardiac and pulmonary primaries all favor the development of such troubles.

Though this disturbance be usually secondary, it likewise has both a symptomatic and an etiologic interest,

as it reacts by increasing and emphasizing the thymic block.

The respiratory side is not exhausted by an enumeration of its diseases. Coughing as a special bother was noted several times (often due to the cardiac complications, as in part may be the other phenomena). Yawning is a frequent and often obstinate peculiarity of these cases, the more striking because of their youth. Dyspnœa, even in default of definite cardiac or pulmonary invasion, was repeatedly noticed; and with no anæmia to account for it. Croup attacks occurred in some of the younger. And several had been fed cod liver oil for presumed "weak lungs."

"These patients breathe badly" (MacCready, 1909). Disturbances of respiration in stammerers have been studied by a number of observers, and with regard to various phases. The chief interest of such papers in the present connection lies in their practical testimony to the occurrence of special respiratory phenomena in stammerers.

Similar are the pulmonary troubles that have been observed in thymism, thus showing the same parallelism as at other points. Swelling of the bronchial glands is known to occur in association with large thymus. Cough asthma stridor bronchitis occurred intermittently in Rachford's cases (of lymphatism). "Attacks of dyspnœa, also observed in thymic hypertrophy" (Sajous).

¶ 15. *Dermal Peculiarities*.—A soft, thin, transparent skin (faintly tawny rather than the "pink and white" so much favored femininely) is frequently noticeable in these patients, such as is well recognized in lymphatism. Often, also, a clear complexion that chaps and freckles easily (Nos. 4, 8, 20). Brunettes are however not exempt, especially in the dark races. Of course, the skin in

childhood and youth is commonly more delicate than in the adult; but in these cases it exceeds the average in frequency and degree (specially noted in Nos. 1, 3, 7, 8, 13, 14, 19, 20, 25). This quality permits the subcutaneous veins to shimmer through more than normally.

Dermal stigmata however occur, perhaps are more than usually frequent and noticeable. Many facial moles in three boys (Nos. 3, 8, 14); a hirsute fringe on the upper lip in a girl of nineteen years; bronzing of skin over abdomen and lower chest (No. 7) agreeing with the tendency noted by Hedinger in some lymphatics; ichthyosis or the lesser xeroderma in five (Nos. 1, 8, 20, 22, 25 with lanugo-like body-hair); a long series of small furuncles (No. 5, after recovery from the stammer); in two cases (Nos. 3, 14) the hair fell out after early febrile periods. Despite their thin skin these youths are not all or always perspirers.

The significance of the dermic outfit of the stammerer is symptomatic and physiognomonic rather than etiologic.

¶ 16. *Other Stigmata.*—To the anatomic stigmata generally a specific clinical value cannot as yet be assigned. Their significance here is in extending the demonstrable scope, both as to structure and time, of the condition that accompanies stammering.

Such things as asymmetries, eye anomalies, abnormal ears, left-handedness, high-pitched voice (Nos. 3, 7, 8, 20), mongol marks, etc., hardly occur with a frequency above that of average children, at any rate represent abnormalities or peculiarities of less importance. Only regarding a couple of these need anything be said.

Ears.—Not only anatomic marks, such as projecting pinnæ (Nos. 18, 23), but functional peculiarities may be included, as in the observations of Chevrin, "A dis-

turbance of hearing, as regards the distinguishing of certain sounds'' (*Sem. méd.*, 1912, p. 37).

Thyroid.—The size of the thyroid cannot be estimated with certainty, except when distinctly enlarged. Yet in many of these children, with their slim necks and thin skins, palpation and inspection give some information on this point. It is at least certain that in none of the present cases has there been any evidence of its enlargement—even though of late the surgeons tell of not infrequent cases of thyroid-thymus. In seventeen it was noted as apparently small; cretinoid face in one of them.

Cephalic Index.—Surprising is the frequency with which these cases show an abnormal cephalic index,* although it does not prove to be so entirely unusual. Here, as the aberrations are in either direction, the average of all the measurements proves to be not only well within favorable limits but an ideal norm, *viz.*, 81.5. Yet half the cases show a marked deviation from the best range (78 to 83). Of the 19 cases with a record on this point, 9 ranged from 78 to 83; 9 were well outside these limits (3 below 77 and 6 from 84 up); while the odd one was on the border line (83.1).

The fact that some persons with abnormal crania and other stigmata are able to slip through life without making any decided break, proves nothing—as is the recognized fact in the case of all merely negative evidence.

¶ 17. *Temperament*.—The peculiar fear and timidity of these patients has been much dwelt upon. Whether it really is secondary to the annoyance which the impediment entails, as claimed by those seeking a purely psychic origin for stammers, or is an innate part of the trouble is not so material, except that it tends to fix the ailment. That

* The method of measuring was that recommended by the writer (in the 1910 article), the standards being those usually adopted.

it is a primary characteristic of the stammerer, however, is indicated by the remark of the one writer that, "Many of the patients of lymphatic type are very fearsome."

MacCready (1909) speaks of the "shy, diffident, self-conscious stuttering child." "Lalophobia or fear of stuttering and lack of confidence in one's self." And Hudson-Makuen found that over 28 per cent of his 1,050 stammerers dated the origin of their affection from the instant of having received a nervous shock.

This quality may appear under various guises, as timidity, tearfulness, sensitiveness, diffidence, nervousness, irritability, temper, excessive ticklishness, etc. It might be termed a psychic hyperæsthesia. We likewise not infrequently find a large thymus in sensitive individuals with a tendency to melancholia (who also respond to treatment, but in an entirely different manner from that of stammerers).

Special sensitiveness of some such type was noted in at least 15 of the 25 cases (Nos. 1, 2, 3, 4, 6, 8, 9, 11, 12, 17, 20, 21, 22, 24, 25). A close association with certain organic features, as retrognathism and slim neck, has been noted above.

¶ 18. *Mentality of Stammerers*.^{*}—The mental status of these patients does not bear greatly on the present discussion. Nor, owing to their impediment, are correct conclusions regarding their mentality always easy to reach. There also proves to be a double question here; one part relating to the stammer and its active concomitants, the other to any underlying or permanent organic defect. Experience shows that in even very unpromising cases, as the stammer improves, the mentality shows a clearing-up sometimes marvelous and always hard to foretell.

^{*} Mental development, retardation and defects, degeneracy, excessive timidity, stigmata, etc., might come in question, part of which subjects have already been touched upon. Not included is the so-called idiota thymopriva, of opposite origin.

Although, as noted above, many stammerers have an ample intellectual endowment,* a certain number show something amiss on this side. Whether the proportion is larger than among average children has been questioned, but seems probable.

Mygind (1898) found stammering allied to the so-called degenerative neuropathies, and that stammerers frequently show many stigmata.

Scheppergell (*Phila. M. J.*, 1899) also emphasized the neuropathic origin of stammering.

Emil Mayer (in Posey & Wright, 1903, p. 1050) speaks of stammering as: "A neurosis which is etiologically related to the so-called neuropathies of degeneration, to which diseases like epilepsy, hysteria, neurasthenia, chorea, and insanity belong. This relation is the stronger, as many of the latter diseases are found in the family of stammerers," or, he might have added, in the stammerers themselves.

Barr ("Mental Defectives," 1904, p. 143), speaking from his large experience with institutional defectives, finds that, "Stammering, although not frequent among defectives, is occasionally encountered." On the other hand Liepmann and also Stier note that there are many stammerers among the weak-minded (*Neurol. Centralbl.*, 1910, p. 1024). Discrepancies of this kind are often due to the type of cases staticized. Allowance must also be made for the handicap of such children often involving loss of school opportunities.

Hudson-Makuen (1914), in his analysis of 1,050 cases, found "that about four-fifths of all stammerers are of average mentality and that only about one-fifth are be-

* Many famous persons of history has been stammerers (v. Introduction to Lewis and Hynson's "Stammering and Stuttering," Detroit, 1902).

low the average; only about one per cent were far below the average."

Some of these patients, though bright enough and mentally endowed, are yet peculiar and even degenerate. With all their mixed phases it is often difficult to know where to draw the line in classification.

Of the 25 cases, three (Nos. 2, 3, 13) were retarded or slightly defective mentally, though not imbeciles, and one of these is now so far improved as to be apparently normal. Two others (Nos. 4, 10) were mentally capable, but degenerate. Another showed peculiarities, not of decisive character. This proportion is doubtless a little large, some cases seeking treatment for mentality as much as for speech; still, it agrees well with Hudson-Makuen's larger figures. Some of the others might not come up to very exacting standards.

There were also three epileptics (Nos. 5, 8, 22). Two of the three showed no mental impairment, and the other chiefly after years of the trouble.

From all the evidence it does not appear that mental defects play any special role in the production of stammering. It would be easier to defend the opposite theorem, that the stammerer's dyscrasia causes occasional mental blemish, or that the two when they concur are co-ordinate results. It is but natural that defectives occur in a little more than average frequency among persons with the various morbid conditions exhibited by stammerers.

Control Cases.—To further determine the relative value of some of the findings, two other series of ten cases each were examined as a control.

In the matter of height, sufficient standards for comparison exist and were utilized above. Many points need no comparison or control—adenoids, tonsils and nasal troubles have been well studied. Some things, such as

pulmonary affections, cardiac troubles, bone changes and epilepsy are pathological no matter if exhibited by every individual in a community. A few points were selected as best adapted to comparative estimate.

The first control series consisted of three girls and seven youths from 7 to 21 years of age, in the wards of Kings County Hospital, mostly accident cases (to secure as normal representatives as could be found there). Even so, at least four of these proved to be backward mentally, if not more definitely defective.

The other group was made up of ten public school boys, 13 to 15 years old, selected by the principal from the 8A or 8B grades (as evidence of fair mentality), but several of them not fine physical specimens.

Of the whole 20 cases only one, a boy of seven years at the hospital, had any thymic dulness. With him it was only up to about the manubrium; and he proved to be a slight stammerer (as shown by his repetition of single syllables or words and as corroborated by the nurse).

Cervical glands were palpable in each of the twenty, though but slight in five (averaging larger in all the school boys of both control groups).

Projecting scapulæ were present in seven of the school and in one of the hospital groups. The showing of the school group in this respect may have been in part due to the fact that they were taken from deskwork (leaning on their elbows) and immediately measured.

Hypotonic elbows were present in fourteen, including all three girls.

None showed marked prominence of the manubrium; a slight suggestion in one and doubtful in four others. One showed a manubrial angle, and three others a trace of it.

The precostal veins were shown faintly in eight.

In about one-half of each group the cephalic index

proved outside the standard (lowest 74+, highest 85.6). This accords with the ratio in stammerers.

A slight depression of the lower sternum was noticed in one hospital case and in half the school group.

These control cases do not therefore essentially change the bearing of the findings in stammerers. They merely serve to minimize the relative importance of some of the accessory phenomena, and emphasize that of the thymus and other factors.

IV. GENERAL REVIEW.

Bearing of the Findings.—A review of the above cases shows that closely associated with the stammer are a number of manifestations, several in each case and integrating or allied in kind, though not always equal in degree or exactly identical in their combination.*

While the average person may present peculiarities and little deviations from the norm, any such considerable number association and comparative constancy as in these cases, and where they dove-tail in and make a connected whole, can only be explained on the ground that there is a definite disorder common to the group.

The above cases afford evidence both positive and ample that the *muscular*, the *circulatory*, the *osseous*, and the *lymphatic systems* are all involved in the subjects of stammering, and to an extent that is readily appreciable. Even the *nervous* system does not entirely escape; at least

* In a study that has grown accidentally out of observation instead of a previous plan, and where the important points could not be foreseen, it is inevitable that the percentages must err, if either way, by being too small. And many of the cases were seen in private work, where it is more difficult to carry complete records. As an additional embargo on completeness, ten of the cases (Nos. 2, 4, 9, 10, 12, 15, 16, 17, 21, 24), were seen but once and in part hurriedly, with corresponding imperfection of record. Little effort was made for completeness in case of the better established facts regarding stammerers.

Work with the endocrine glands for many years had furnished a certain familiarity with the common facts in this field. But the main generalizations in this paper and much of the basis therefor have been a gradual development.

epileptic and abnormal mental cases show an unusual incidence. In the case of each of these structure-systems the conclusion is based not on isolated manifestations but on a number and with a frequency sufficient to demonstrate a wide implication of each, and consequently an unusually comprehensive involvement of the body constituents as a whole. In at least a functional sense the *digestive* might be added to the other systems showing frequent aberration.

That a general systemic condition with multiple manifestations accompanies stammering, that it has an intimate relation to the habit, and that it cannot be secondary thereto, must be sufficiently evident. This affords solid ground upon which to proceed, whatever the general condition be termed or however interpreted.

The stammerer habitus diathesis or complex can at times be independently recognized. In some cases, brought for other troubles, it has been possible, after noting history and physique, to suspect a degree of stammering, a suspicion that on inquiry has repeatedly proven to be well founded. There are, however, near-stammerers enough to prevent any conceit of infallibility in this regard.

Of the different morbidities found associated with stammering, block in the thymic area is constantly present and is perhaps the most definitely so of any. In natural association with this is the lymphatic hyperplasia so regularly present in the youthful cases. While hypotonicity, especially of the shoulder-trunk type, is almost equally common, it varies too much in degree and is too common in others, to well be the central cause; it can evidently be most effective by aggravating the thymic condition. Developmental bone-involvement, of the type recognized in thymic disorders, is common. Cardiac troubles are im-

portant, but as they are not always present they can hardly be the real cause. And the like applies to naso-pharyngeal and other features.

It is next in order to formulate an interpretation which harmonizes the various facts and at least tentatively meets the requirements. It evidently must center around the thymus as the dominant and most constant element in the causation.

Analogy and Interpretation.—A close analogue of stammering is furnished by the well-recognized occurrence of asthma (a respiratory neurosis) as a sequence of chronic throat troubles, and still more by so-called thymic asthma. According to Knopf (*Münch. Med. Wochenschr.*, 1908, No. 51), stammering and asthma are closely related and in fact complementary, the one always excluding the other. And Gutzmann (1908) says, "We may here observe what is almost a parallel between stuttering and asthma as reflex phenomena." Little would be gained, however, by terming it a respiratory neurosis, though such a designation might be preferable to the common ones above quoted.

The peculiar deaths of young bathers and swimmers and certain operative cases might also be recalled, in which an enlarged thymus has been found at autopsy—the handicap of some sort to respiration constituting doubtless the fatal extra factor.

The most natural thing is to figure stammering as a reflex interference with the ordinary respiratory rhythm or phonatory sequence, an inhibition. While the basis of this is laid by the systemic condition of the patient, the immediate source of the reflex appears to be the abnormally persistent thymus. The episternal notch is one of the most sensitive spots to pressure. Everyone knows the disagreeable sensation thus produced, an incipient stran-

gling. Any pressure here affects the respiratory act, easily inducing an inspiratory gasp or short cough, a reflex break in the normal breathing process. As this spot is immediately adjacent to and even part of the generic area for such a reflex, we have thus an externally demonstrable foundation or parallel.

Such cases as that of Garel (*Bégaiement guéri à l'occasion d'une trachéotomie dans le cours d'un cancer laryngé simulant une lésion syphilitique*, *Rev. hebdomadaire de laryngologie*, 1902, II, 721) are thus perfectly intelligible.

This may, however, be only the leading factor in the causation. As has been so strenuously contended regarding certain other sequences of thymism, purely mechanical explanations may not fully suffice.

It might be imagined that the general condition in these cases carried with it a toxine with a selective action on the "speech mechanism." But such an assumption does not explain the facts as satisfactorily.

The course of cases under successful treatment is not quite as decisive as might be expected. The stammer and the thymus are apt to ebb together; but occasionally the stammer takes a little more time about it. Such delay might mean that at times the improvement in stammering awaits not simply the correction of the gland but also the naturally slower correction of something in the system, that is under control of the gland, *e. g.*, circulating products or activators. This, however, can be more simply explained either by the time required to overcome a habit, or by the fact that for a while there is a strong tendency for the gland to "come back," thus indicating that it takes time radically to correct and control the gland itself.

Allied Conditions and Apparent Exceptions.—Those who work clinically with internal secretions and their disorders know that many of the latter are not isolated disease-units (closed groups of symptoms), but merge into allied states or syndromes. The need of further nosologic stakes in the wide field of lymphatism is well

recognized. The present combination or picture is sufficiently common and distinct to constitute a useful type, and until more exact lines of classification are devised, the stammer complex is fairly entitled to hold a place.

These cases appear to belong to a larger class with a symptomatology made up of the manifestations above given and often others so well known as to need no review here. Or, as Bartel (1908) says, "Status lymphaticus is only part of a more or less general hypoplastic constitution." Taking the whole class no single feature may be invariably demonstrable, any sign may be in abeyance, and yet the general picture or semblance remain definite. Even the thymus itself may not be recognizable in pronounced status lymphaticus.

So far no case of stammering, however severe or slight or at whatever age, has been met with that did not show signs of block in the thymic area. Possibly extra inflation of the lungs may temporarily obscure it, and some variation in extent occasionally occurs. Usually there is also sufficient indirect evidence of the kind already noted.

On the other hand there may be evidence of unusual material in the thymic area, without attendant stammering.* While this will hardly raise a thought in the medical mind, those not so trained may easily consider it in conflict. We know that individuals do not react just the same to like causes. Then the local anatomic peculiarities, a little difference in the upper chest conformation or in the disposition of the thymic block could easily account for the different response or such an additional symptom as stammering. Cases of this kind (large thymus) are moreover predominantly observed in other members of stammerers' families; and as stammering is known

* Not all cases of large thymus stutter, but all stutterers show large thymus.

to be frequently a family affair (*v. infra*, Heredity), such occurrences can be readily understood. There are consequently many near-stammerers who have escaped that manifestation by a close margin. This accounts for the fact that suggestion in some cases seems sufficient to provoke the habit.

Enlargements of the thymus, of other character or developing later in life, as from tumors or in neuromyasthenia gravis, though at times affecting speech slightly, do not produce stammering. Most of these occur after the stammer age has passed. Doubtless the general condition, upon which emphasis has been laid, and the smaller passages in youth also serve to account for this.

Varieties and Partial Forms (of Stammer).—For exactness of adjustment and control, the speech mechanism is, barring possibly the ocular function, the most delicate in the body; and is, moreover, developmentally so recent an acquisition as to be the least stable. Consequently it is one of the most easily disturbed.

Without bias as to “tendency,” “idiosyncrasy,” “weakness” or the like, it may be recognized that, as is practically true with all morbid conditions, some individuals develop stammer more readily than do others.

There is also considerable variety as regards the amount, degree, constancy and even apparent character of the speech disturbance. Brief or relative remissions frequently occur, especially in the lighter cases. Stuttering is, of course, here included under the general head of stammering. The dictum of Bluemel and others that “the distinction between stammering and stuttering is an artificial one” seems to be generally accepted.

Stumbling, hesitating, delayed or dragging speech may be associated with stammer, or in some cases occur independently as an equivalent or initial stage of stammer.

An interesting subvariety of this kind is illustrated by the two following cases, both in young women:

One was that of a high school girl of sixteen years. She complained chiefly of "a clutching at the throat" when reading aloud or speaking and not otherwise. Her father had long been affected in exactly the same manner. While this was very suggestive of hysteria, and in fact she had attacks resembling *astasia-abasia* (cf. also *knee-falling* in Case 14) with "shivers," there was a very close approach to the obstructive type of stammering. She showed evidence of a large thymus (the dulness not reaching quite as high as in the above cases) with many of the concomitants.

The other was that of a teacher, twenty-five years of age, who since youth had occasionally stammered an instant (which fact gave the clue to the nature of both cases). For several years now she has been troubled by sudden sensations of choking "attended by a shiver," mostly by night but also by day; also much swallowing of saliva,* a *sialuria*, at any time. She also showed most of the concomitants of the stammerer, including thymic dulness (slightly under the full type).

These two cases appeared to be "affiliates" of stammering, but the slightly smaller thymus and good general condition favored their freedom. Such partial forms yield readily to treatment; at least each of these made a good recovery (X-ray used but once, in the second case).

Casual or occasional stammerers are not so rare; and when there is a history of early addiction to the habit a degree of thymic persistence is often still demonstrable. Some persons are subject to it all their lives if they become angry—usually also as a residuum from a more pronounced early habit. And there is the classical

* In another case of thymism, not in this series, there had been an excessive flow of saliva for years—perhaps one of those symptoms which by their inconstancy in *status lymphaticus* are so confusing.

assumption that it is natural to stammer out replies when excited. It is hardly necessary to decide whether such forms belong in the present category. Indeterminate also is the stammering which intoxicated persons are supposed to exhibit. Hysterical and imitative stammering are also recognized, and have a literature; they should not be thrown into the functional discard without careful examination. "Thirty-two per cent of my patients (1,050) confess to have associated with others similarly affected" (Hudson-Makuen).

Lisping.—The subject of lisping is not necessarily included in the present paper, and can be but briefly touched upon. The trouble may be said to be even less understood than is stammering.

Certain facts suggest a closer relationship than that of mere fellow-ailments of speech. The frequency of lisp in girls seems to balance up with that of stammer in boys; the association of lisp with stammer in some cases. One writer at least (Cadwalader, 1912) appears to consider the two closely allied, and Scripture treats of both in one volume.

On the other hand independent cases of lisping occur without demonstrable thymus; and there are cases like No. 3 where the stammer is cured but the lisp is left.

The material at hand is not sufficient for a profitable discussion of the matter.

The Great Excess in Males.—"The male sex has by far the greater predisposition to stuttering. Colombat asserts that one person in 2,500 stutters, but that only one woman in 20,000 is affected" (Romberg). Greene (1901) listed 229 males to 27 females. Emil Mayer (in Posey & Wright, 1903, pp. 1050-51) says, "Fully 95 per cent are males. It has never been explained why this should be." Gutzmann (1908), in his 569 cases, found

422 boys to 147 girls, figures referring only to youth. Hudson-Makuen (1914) found 77 per cent males to 23 per cent females among his 1,050 cases of stammering. The excess of males in the present series of 25 corresponds sufficiently, for a small number, with these larger figures.

Not only is the incidence of this in youth much greater among boys, but the sex contrast is shown even more by the persistent cases. These are still more exclusively males, indicating that those which do occur early in girls are of lighter character. Gutzmann, for instance, states that while in childhood it is twice as frequent among boys as girls, in adults it is nine times as frequent in men as in women.

Explanation of Partiality for Males.—This peculiar feature has long been recognized, but, beyond various interesting suggestions, has presumably been passed over as an inscrutable effect of sex. It has nothing however to do directly with sexual functions; while as a matter of thymism it becomes readily explicable.

a. Sex and Lymphatism.—In the first place, in view of the sex proportion among stammerers, it is natural in seeking an explanation, to inquire if any difference in this direction is shown by the general run of the subjects of lymphatism.

Very little is to be found on this point. One writer casually expresses the idea that the sexes are equally affected with this constitution—and, considering the individual opportunities of most observers, this would be the natural presumption. Bartel (1908) is of the opinion (based on adult cases) that the hypoplastic constitution and large thymus are more common in the females.

However, by considering only youthful cases and combining a large number from many sources, a different and

for present purposes more authoritative determination is reached.

Statistics of published cases of lymphatism, collected for the first sixteen years of life, show 60 males to 41 females. These totals are not materially affected by any one observer; in fact the figures happened to be gathered in two groups each of which showed a like ratio—always approximately 50 per cent more males than females.

These figures include all the cases, duly verified by autopsy or operation (largely single observations), found in the hundred or so most available reports, many of them European. Only those, of course, could be included in which age and sex were indicated. The numbers for each year are inadequate; but regarding the period of childhood and youth they suffice for general inference.

Cases reported from seventeen years on, even barring the observations of Bartel, show a less pronounced dominance of males though somewhat the same tendency as in youth.

The bearing of these statistics on the question of "Sex and Lymphatism" is strengthened by certain allied observations:

Paltauf (*Wien. Klin. Wochenschr.*, 1889) gives a table of 143 male to 82 female infants (all but four of them under one year of age) who died suddenly from asphyxia without other adequate cause and attributable to large thymus. The proportion here it may be noticed agrees fairly with that of the above figures for the whole of youth.

Perrin's series of cases in one family, likewise not included in my tabulation, where of eleven children the nine boys all died in this manner while the two girls lived. Somewhat in the same sense is the observation attributed to Haugsted (1832) where three brothers suf-

ferred from it, only the oldest surviving. Of course, it is possible that each of these family groups inherited from one parent—but if so there should be parallel and equally striking series from the other sex.

These facts appear to demonstrate that in all the younger years up to early adult life lymphatism is considerably more frequent in boys than in girls. In adult life the relation may as yet be less certain. But, so far as youth is concerned, and that is the period that decides in the development of stammering, the sex ratio is greatly to the side of the male.

This predominance of lymphatism in young males, however, may only suffice to account for a portion of the excess of male stammerers—unless indeed, which is quite possible, a certain minimization of the one disorder gave a much larger reduction in the other.

With respect to the sex ratio, stammering not only thus agrees with that in thymic enlargement but it differs radically from that of the adjacent thyroid. “The female is more frequently the victim of goiter than the male” (Kocher, *v.* Sajous). And in the case of students investigated by Hall (1914), goiter was 58 per cent more frequent in the female than in the male.

b. Type of Respiration.—A second and complementary reason for the sex preference is supplied by the fact that in males we have comparatively the abdominal type of breathing, while in females the thoracic prevails. The latter naturally favors the lifting and freeing of the upper outlet of the chest, and thus does away with thymic block and its consequences. While this is not sufficient in all cases of that sex to prevent direct sequels, it answers in a great many, and thus can account in considerable part for the low ratio of female stammerers. This anatomic difference of the sexes becomes more pro-

nounced as youth progresses, and thus helps to account for the larger improvement in female stammerers as they reach toward adult life.

This view of the cause of sex preference in stammerers is not of itself altogether new, though it fits in well with the present exposition. It was utilized by Greene (*N. York M. J.*, 1901, lxxiii, p. 635): "Some investigators have suggested that the different mode of breathing of females may be the cause of their comparative immunity from this blemish of utterance. . . . In females, costal breathing is the habitual mode of respiration, hence their lungs are generally well supplied with the quantity of air which is necessary for speaking purposes, and cases of stammering caused by deficient inspiration are very rare among them."

However brilliant at that time such a suggestion of the dependence of stammer on sex type in respiration, its application was necessarily somewhat empirical; at least it could not then be made in the exact sense that is here done as a direct participant in thymic block.

Age of Incidence.—The time in life at which stammering develops might well direct inquiry to persistent thymus as a likely source.

About the only other biologic or near-synchronous phase that could here come in consideration would be puberty or the sexual maturing. But that this can have no close relation thereto is made clear by the occurrence of stammering at as early as two years of age, and its much less frequent onset just at or about the period of most active sexual progress.

But little exact information happens to be at hand on this point. Romberg says: "Rare before the fourth year of life, it increases from the seventh to the fifteenth." In all of Levine's 32 cases it began "between the ages

of five and eight years" except one later. Hudson-Makuen finds that it usually begins "between the ages of two and four or five."

Of the nineteen in the present list, where the date of onset is indicated, it began by the fifth year in twelve (Nos. 2, 4, 7, 8, 9, 14, 15, 17, 20, 21, 22, 23), in three more by the sixth year (Nos. 3, 19, 24), and in the other four from the seventh to the eleventh year (Nos. 1, 10, 13, 25). In many even of these cases it doubtless really antedated the age given. Indirect inquiry or subsequent review often suffices to materially push back the date of onset or of a preliminary period.

Heredity.—Stammering, as shown by Colombat (in two-thirds of his cases, according to Romberg) and by Gutzmann, is very frequently an hereditary affair. Lewis and Hynson (Detroit, 1912), found evidence of heredity in 394 of 1,000 cases. Hudson-Makuen (1914), in his 1,050 cases found 39 per cent "had relatives who stammered," and speaks of "those who inherit the physical conditions which give rise to stammering."

This feature also finds its counterpart and origin in the tendency of errors of the endocrine glands or for that matter in any part of the developmental process, to reappear in the descendants. As was pointed out by the writer (1909 paper, p. 357), in discussing the subject of internal secretions and their malactivity, "In most of these forms there appears to be a noticeable tendency for the same states to recur in the offspring of those who have shown peculiarities in the primary development of these glands." We can thus see that it is not specifically the stammer that is inherited, but the tendency to thymic or developmental error. Observations of this kind serve to put the heredity of nominally functional disorders on a more tangible basis.

Corresponding to heredity in direct line is the occurrence of stammering in more than one of the same generation. And this is likewise paralleled by the familial occurrence of cases of enlarged thymus (Hedinger, *Deut. Arch. f. kiln. Med.*, 1906, lxxxvi, p. 248; also Perrin, *Ann. de Méd. and Chirg. infantl.*, 1903); or as Cocks puts it (1912), "Status lymphaticus is apt to run in families."

What Becomes of Stammerers?—The much greater frequency of these cases in youth than in later life raises a query as to what becomes of them and their ailment.

A somewhat larger proportion of those thus afflicted, compared to average youths, may die early. At least their general condition must be a handicap. And Bartel has shown that an undue proportion of the subjects of lymphatism succumb before middle life.

The frequency of cardiac lesions (*v. supra*, ¶ 13) must also reduce their expectancy of life. The older subjects were found free of the severer forms. While this complication in the relative veterans may have been outgrown or compensated, the cases that could be followed for some time did not indicate this, and the simpler view is that those with the cardiac burden added to their other imperfections are apt to drop out.

In many other cases, however, the prognosis, both as to life and to speech, is fairly good. Romberg states that "old age carries with it a spontaneous cure of stuttering." Ex-stammerers in the best of condition are frequently met with. Some, however, preserve the habit long, as in one case of 65 years in the above list.

Experience shows that the reduction of stammerers in adult life is often due to the relative or absolute recovery of many cases, especially of the milder degrees. For, besides the few distinct stammerers of middle and later

life we can note a larger number who show some sign of this impediment either constantly or casually as when excited angry or embarrassed.

“A certain minority are destined without skilled aid to acquire relatively smooth speech while still in childhood or in early youth; another proportion are capable of self-recovery early in adult life” (Kenyon, 1910); but “the great majority of stammerers,” he thinks, are chronic.

As to whether ex-stammerers with a history of spontaneous cure still show signs of a thymus, it can only be said that in the few cases so far examined, no trace of the dulness was discovered where the recovery was complete, but that in those cases with only a partial and incomplete recovery there was evidence of its persistence to a corresponding degree.

While we speak of cures, there is great question whether absolute and uniform recovery from all trace of the habit ever really occurs. Under stress, excitement, association, respiratory oppression or the like, some indication subjective or objective of the early hitch is apt to show itself. For practical purposes, however, the recovery may be full and complete.

Examination of Thymus (Physical Signs).

An outline of the methods employed in determining the thymic enlargement may be in order (largely the same as described by the writer in the *N. York State J. M.*, 1909).

The first two (*a* and *b*) which have had some vogue for this purpose, usually fail in practice. The third and fifth (*c* and *e*) are more often available, chiefly in corroboration. The fourth (*d*) is the only constant feature.

The present style of female neck-dress of the younger element, that here comes mostly in consideration, allows

a sufficient application of some of these methods for a preliminary conclusion; where this is positive a fuller examination can follow.

A few of the various diagnostic claims may first be mentioned; these refer mostly to infants and to enlarged thymus in general without reference to stammer.

Veau and Olivier (*Arch. de Méd. Enfnt.*, 1909, Nov.), in children of 11 to 12 months, mention—permanent dyspnœa (relieved by intubation, but increased by bending head backward), suffocative attacks, cyanosis, tracheal stridor, even trouble in swallowing, edema of the neck, eczema, prominence of manubrium, resistance in the jugulum, dulness on percussion, small Roentgen shadow.

Barbier (*Bull. Soc. Pédiat.*, 1909; *v. Centralbl. f. m. Wissensch.*) observed a yielding of the thorax in respiration of the same type as the lasting deformity in rachitic children, and known as pectus carinatum or funnel chest.

A constant short cough, and dyspnœa either continuous or at first in attacks, have also been noticed.

Other proposed tests, as by serums, blood cells, etc., do not as yet appear to have any established value in thymus diagnosis.

a. Palpation.—However practicable this may be in the case of infants or the very young, in older cases the writer has rarely been successful in thus demonstrating a portion of the thymus accessible above the sternal notch. There may be forms where this can be accomplished by special aids, such as exhaling and leaning forward, or on the contrary while the patient's head is tilted strongly backward. Of course, where found, it can be considered decisive.

Of similar import is prominence of the jugulum in expiration, observed by Klose.

b. X-ray Inspection.—At one time it was thought that this afforded the final and only conclusive proof of persistent thymus. Wathin (in Osler's *Modern Med.*, 1908, iv, 796) says: "The radiographic examination offers the most certain method of diagnosis of thymic enlargement."

It proves, however, to be very uncertain and usually impossible. Such is the experience of our best workers (some of whom privately grant they have never succeeded), and is sufficiently attested by those elsewhere. At best some indefinite thickening or glands is all that can be made out.

Sprinzels, in demonstrating a case of dwarfism at Vienna (reported in *Deut. med. Wochenschr.*, 1912, Nov. 21, p. 2247), says: "The thyroid is not palpable; on the breast the present and strikingly dilated veins point to persistence of the thymus; neither of the two organs is visible in the X-ray picture."

Basch and Rohn (*Deut. med. Wochenschr.*, 1911; trans. in *Am. J. Dis. Children*, 1912, Feb.) were also unable to establish thymus findings by the Roentgen ray, and "regard the question of the clearness of the thymus shadow as still unsettled."

Of his one case where it was tried, Cocks says, "The diagnosis of status lymphaticus was not made during life, owing to the fact that the X-ray plate did not show the gland." Better success is reported by Delavan (*Tr. Am. Laryngol. Assoc.*, 1914).

With perfection of detail and technic this method may yet meet expectations.

c. Prominence of Manubrium.—This mark, as an acute phase, has been mentioned by French observers. Although it may occur in other conditions (or at least be simulated, as by fracture, barrel-chest or possibly de-

formity of other origin) it has some positive value when present. Its absence, however, has no negative significance.

The degree and form of the elevation vary from a scarcely perceptible fulness to that of a moderate flat boss. A good layer of body-fat, as the panniculus in females, tends to obscure it, and vice versa.

Perhaps this sign, as a fixed skeletal change is more frequent in the older or inveterate cases; and is correspondingly less to be expected in the young, in fresh cases, and in females. But there is no absolute rule in the matter. This was noted in 11 of the present 25 cases (*v. supra*, ¶ 12), as compared to no marked case and but five slight suggestions of it in the twenty controls.

As an acute or transient phenomenon Veau and Olivier (quoted above) have noted it in thymic infants. And Méry and Perturier (1909), during the suffocative attacks in a five months old child with large thymus, noted a bulging of the manubrium and adjacent parts, just corresponding to the form of the enlarged gland. Such observations, like the parallel one of Barbier (*v. supra*), have double interest here, as they show, only in higher degree, the type of bone process the similar but more lasting sequels of which were treated of in ¶ 10.

This manubrial boss in the adult, however, need not be attributed to resistance or uplift by structures beneath. It is doubtless more largely due to the general mechanical conditions of the front-chest wall, when the frailer ribs are unusually soft.

Sterno-Manubrial Angulation.—A variety of this last form, that may not have received attention in this connection, is where the prominence shows itself chiefly as a knuckling or bulging forward at the juncture of the manubrium and body of the sternum. This was noted in five of the present cases (*v. supra*, ¶ 12), as compared

with four to some degree in the twenty controls; indicating that it may not be a very decisive mark.

In fleshy individuals this variation is only discoverable, if at all, by palpation; and such verification of the angle is a help in all lesser degrees.

Two forms are distinguishable that may give the impression of an angulation at this point. In the more frequent there is a distinct angle forward, the manubrium appears tilted a little backward, and this is the more striking in those cases where there is a grooving or sinking-in of the lower portion of the sternum.

In the other form, instead of a true angle, there is a narrow ridge or thickening transversely along the line of juncture of the two bones.

d. Percussion (Dulness).—Whether the thymus can be correctly examined by percussion has been much discussed; opposing views are in plenty; Kolb even adds variety by speaking of a “far-reaching subjectivismus in the percussion of the thymus.” Yet it is evident that, so far, most observers still have recourse to this method, even in controlling other findings; they use it, bank their material on it, and bother little about the objectors.

As to differences of opinion regarding the presence or significance of dulness in these cases, we are naturally influenced by our ability or not to demonstrate it. And here as everywhere negative evidence must bow to positive.

“The area of dulness (trapezoid), cleaning up on change of position,” says Lerch (*Med. Rec.*, 1909, I, 392).

“The child must be held face downward during examination in order to bring the organ forward against the chest wall” (A. Jacobi, per Cocks). This latter plan is hardly practicable in stammerers of much age.

Application of the Method.—Thumping the chest with the heavy massive fingers that we sometimes see, cannot be expected to be applicable here. A fine finger, light tapping, acute senses of touch and hearing, quiet surroundings, training and experience, all count. In doubt or by preference recourse can be had to aids such as the “stockel-plessimeter” devised by Basch and Rohn for the particular purpose of light thymus-tapping. There is ordinarily no trouble in demonstrating the dulness to the practiced listener.

In many cases and over more or less of the area it is a relative rather than absolute dulness that is obtained. Often there are parts of the area (*v. supra*, ¶ 12) where the note shades off so gradually into the pulmonary, that careful and repeated percussion is necessary to make the delimitation. For accurate comparison of the percussion note each series of taps should so far as practicable run along either a rib or an interspace, rather than indiscriminately jump from one to the other.

For record and for comparison of progress it is necessary to keep accurate outline-drawings of a case from the start. In the earlier cases the custom was followed of making wax-paper tracings of the dulness in each. Of late the charts, kindly prepared herefor by Dr. Beers, have proven more satisfactory. Many of the cases were also drawn by him direct from life. The observer himself with a little practice can transcribe the finding to the chart better than can any non-medical second person. Of course, the first preliminary is to percuss and mark out the dulness accurately.

Significance of the Dulness.—As the occurrence of some dulness here is not unusual in the very young,* there would be little use in giving charts in such cases as

* Blumenreich found an area of dullness over the thymus up to the fifth year of age.

No. 9; mention of its presence suffices to show that in this respect there was no divergence from the older patients.

For the purpose of the present paper, as already noted, it is not very material whether the dulness found in these cases is due to thymus or to something else. The main thing is that a dulness, and one that in all but the very young is abnormal, has been demonstrable in each of these cases. As it is due to the thymus or to something in its place, it is termed thymic dulness.

My findings coincide with those of Sahli (in contrast with some others) that the thymic dulness is usually continuous with that of the upper border of the heart, at least in these older cases.

e. Dilated Surface Veins (Precostal).—This is a phenomenon described by the writer (1909 article) as occurring in certain cases of large thymus (*v.* also reference above to Sprinzels). It is an enlargement or distension of the veins over the front of the chest; these radiate mostly down and outward, and are slight or absent over the manubrium and upward. The skin in many of these patients has a specially translucent quality (*v.* ¶ 15), and lets the venous markings shine out with unusual clearness; a strong light aids greatly in tracing them out. Doubtless this charging of the veins is secondary to compression of the internal mammary vessels, as may occur with any mediastinal tumor, with the consequent opening-up of a considerable area in this collateral field. It might be compared to the caput medusæ about the umbilicus from block in the portal system, only less in degree and merely stasis in natural channels, a filling-up of the normal plexus of cutaneous veins in this region.

Occasionally there is a feature, to this thymus form,

that may serve then to distinguish it. On exertion, hurry, excitement and especially when the patient is suffering from a cold or any acute increase of his trouble an ample venous plexus of this kind may appear all across the front of the thorax as far as the shoulders and even to below the free border of the ribs. Sitting quietly a sufficient time has the opposite effect, allowing practically all to disappear. Consequently there is no absolute rule about finding this, except that it should be more common and more easily called forth the larger the thymus. A brisk walk of half a mile or more may bring these veins out to the full.

Some traces of them are not unusual in these cases, and to a lesser degree in others. They are best seen in the young, and even then belong to the class of inconstant signs however valuable when present.

V. THERAPY.

The many methods of treatment (new, rational, hypnotic, psychological, mechanical, surgical, hygienic, or by whatever name), that have been proposed from time to time, do not come up here for individual consideration. Each doubtless has been able to count cures, and some have had more than transient success. Certain of these at least have a true physiological basis. But the only therapeutic indications which it is necessary to consider in this connection are those with some direct relation to the new etiologic principles that have been presented.

Since there is often a natural tendency sooner or later to improve, to the extent that some cases make a fair recovery in time, and as the prospect of this outcome can be greatly promoted by medical treatment, stammer-

ing should be included among preferred disorders and not left to chance.

While this side needs further development, anything will be an improvement on the past. Though an occasional physician may have devoted his attention to it, stammering remains one of the most frequent of untreated disorders. Certain measures that have proven of value will be briefly considered.

Habits we know are strong. And stammering, though a secondary matter, may become so established as to be relatively resistant. It follows that for the best success cases of this trouble should be treated early.

The possibility of swollen caseous or tubercular glands should be kept in mind, as well as that of other complications such as epilepsy, degeneracy, etc.

Results Obtained.—As many of these patients were merely seen in consultation or before lines of treatment could be evolved with reference to the new principles, the therapeutic test as an argument pro or con only applies to a part of them.

Various other factors limit the value of any therapeutic test in the matter of stammering. Many such cases get over the embarrassment of talking to a stranger, at least become able to talk better in the observer's presence; to some extent this can be met by taking the testimony of others. Then there is no very exact standard of measuring improvement. The desire to see progress is natural, and influences judgment. Where the stammer has been severe or persistent, there remains as of all habits a certain residuum that is difficult to discount. Irregularity in treatment is often unavoidable. And as yet the surgical is the only sure method of eliding the thymus. For all these reasons it is better not to look

too expectantly to the therapeutic test as the final and whole criterion.

With all these limitations, however, the results have been satisfactorily corroborative—more so than generally with new methods.

Of the whole 25 cases, 11 have not received treatment of this kind (Nos. 1, 2, 4, 10, 11, 12, 14, 15, 16, 17, 24). The remaining 14 have been more or less treated heretofore, some but just begun, with marked benefit in all and cure in part; these include eight more or less complete cures, and six partial cures, five of which latter promise a full result in due time.

The light and fresh forms respond most satisfactorily; and with them should be included such cases as the two successful ones on p. 306 (*sub. Varieties*).

Accessory troubles were benefitted in several—enuresis and mentality in No. 3, seizures in No. 8, enuresis and apparently conduct in No. 13, scholarship and conduct in No. 8, general instability in No. 20, spasticity in No. 18, and of course in all children the ability to profit by school work.

A fair rule to follow is to consider no case cured until the dulness remains permanently below the level of the sterno-manubrial juncture.

The query may be raised as to the possibility of a psychic instead of a physical cure in these cases. The facts suffice for a conclusive answer. Such matters as the reduction of thymic dulness preliminary or coincident to cure, its return with relapse, cases where many kinds of treatment, operation and hypnosis have been unsuccessful though attended with ample suggestion, and especially the gradual rather than sudden relief of the stammer, should be sufficient. Moreover the general harmony of all relevant facts and knowledge with the present explanation

meets requirements from that point of view. And those who demand results from the application of theory can be content.

1. *General Management; Environment.*—As stammering is primarily but a symptom its rational treatment should have in mind not only relief of the symptom and abatement of its immediate cause, but so far as possible should include a radical cure of the underlying or systemic condition.

As not rarely the home atmosphere or associates of these sensitive children are such as to aggravate their tendencies, it is sometimes well to change their environment before the habit phase of the trouble can be satisfactorily handled. Doubtless with this partly in mind Levine suggests isolation and segregation of speech defectives in short classes for special training. Institutional life in itself, however, can hardly be considered advantageous.

For the city youth long summers in the country are most advantageous, not at resorts or under close tutelage, but a life of the fullest activity in the open. In mild cases this may suffice for passable relief. The apparent success, however, may not prove wholly permanent on returning to urban surroundings (well illustrated by No. 20).

2. *Posture.*—This refers specially to better carriage of the trunk, to correction of the winging scapulæ, and to a coincident freeing or increase of the upper chest outlet. The military position, with abdomen in, shoulders up and *forward*, head erect, chin down, and mouth shut, is the desideratum. Where this can be realized, the antero-posterior diameter of the upper chest is increased (sometimes an inch or more, as can be readily shown by calipers), and the thymic pressure thus relieved.

Position in sleep is also to be heeded—mouth shut,

on side, out straight, face free, etc. Many of these patients, however, are young, inert and too much sagged down to carry out the plan well. In those mature enough to be responsive, this serves to fix their attention on something other than their immediate impediment, and also lets them participate in their own rehabilitation. Patients under ten years of age rarely have sufficient appreciation and determination to keep this up with the requisite persistence. And even those of ten or more are not always stocked with sufficient character.

When carried out this plan aids greatly and tends to improve the hypotony as well. It is easy to assure yourself that the requirement is being met, by simply passing the hand across the patient's shoulders, and finding if the scapulæ are kept flat on the chest.

The plan is more effective after the thymus has been reduced in volume, though it is not necessary to wait for that before beginning.

3. *Physical Training; Respiratory Gymnastics; Articulation.*—All the various methods of this paper are entirely compatible with the older and still useful schemes of breathing, exercise, and muscular discipline. However much or little is thus accomplished, they are rational and beneficial so far as they serve to enlarge the upper aperture of the thorax, reduce local stasis, and thus relieve the immediate source of the trouble. This phase of treatment is complementary to that given in the previous section. It likewise serves to combat muscular hypotonia and in perhaps the best manner available.

Mention may also be made of Claiborne's treatment by reversal of dexterity. And MacCready (1910) thinks the use of the left hand is distinctly curative in right-handed stammerers.

These older methods of mechanical and respiratory discipline can now be placed on a far more exact and permanent basis. The indications are precise—improvement of hypotony, correction of shoulders and trunk slouch, increase of the antero-posterior diameter, especially of the upper chest.

4. *Adenoids, Tonsils; Nasal Obstruction.*—These may need removal or other attention. While most cases of the day have been thus operated one or more times, the treatment too often has not been duly followed up. We find such a child, though with a cleared naso-pharynx, still making a fly-trap of its mouth, perhaps still sleeping on its back, unrelieved of a too narrow palatal opening, with catarrh or post-operative states, etc.* Of course coryza, laryngitis, or any proximate inflammation may be as disadvantageous as direct block.

5. *Everything tending to congestion in the thymic region* should be prohibited or corrected—such as excessive exercise, overwork, hurrying up stairs or hill, chilling, bad air, even swimming, cardiac weakness, cold feet.

Abnormal conditions of every sort about the chest and upper air-tracts, especially if tending to produce irritation, pressure or obstruction, should be remedied. Strongly to be condemned in this connection is the custom of making children go about in cool weather with legs bare or poorly protected.

6. *Internal Remedies.*—Circulatory braces are often required (never depressants), as strophanthus, spartein, brucia or the like. These are useful either as adjuvants to other agents or as correctives of the troublesome cardiac affections. Some heart cases appear specially resistant

* Largely responsible for this are the present wholesale methods compelled by school and health boards, rendering individual and after-care impossible.

—quite intelligible as a result of thymic stasis and congestion.

Alkaline iron preparations are occasionally called for, even the syrup of the iodide. Rarely a child has an idiosyncrasy against iodine in any form.

Other internal agents, as laxatives, belladonna, arsenic, salicylate, etc., may be needed at times.

Small doses of thyroid—some antagonism between thymus and thyroid has been claimed. In certain of these cases a degree of hypothyroidism seems present. If palpation, especially of the isthmus, succeeds in indicating a diminutive thyroid, so much the more definite is the indication. But the favorite large doses are unwarranted both theoretically and practically. Not to substitute but only supplement the gland or correct some imperfection is the design of thyroid medication here. For this purpose, if the dry gland per mouth is given, doses of one-twentieth grain twice or thrice daily after meals usually suffice. This amount does not tend so much towards depression, although in the adult even this minimal dose may occasion a gradual reduction in weight. Exact record of the body weight gives us an admirable control. It is in the young and in recent cases that most can be expected of this; and in the young, if really needed, it favors an increase of avoirdupois. An occasional child does not do well on it, as proved to be the fact in Nos. 3, 7 and 14 (chiefly those who cannot take iodine).

7. *Mild Local Derivatives or Absorbents.*—While it may not seem likely that counter-irritants or such agents can do good here, in practice they seem of worth.

As these cases are of the lymphatic type, the cervical glands are palpably enlarged and also warrant a little attention in their direction.

The local cold pack, oleate of mercury, oil of juniper,

and the iodinated oils have been tried, but not with great satisfaction. By far the best results have followed recourse to a method that many years ago gained favor in the relief of enlarged cervicals. It is the thorough rubbing-in daily of potash soap (sapo viridis* or the old household soft soap; a more elegant but not more effective sapo mollis prepared with cottonseed oil is also on the market). A quantity the size of a small marble can be rubbed in nightly over the thymic area; and where there are large glands up the neck, half the amount can be kneaded in on each side of the same. When the skin becomes over-irritated, it is only necessary to suspend use of the soap a day or two.

Sapo viridis or such other local agent is chiefly useful in the very young and in fresh cases. In children the skin reacts much more to such means, and any absorbent or derivative effect is bound to be more pronounced. In inveterate cases and in older patients little is to be expected from this method.

8. *X-Ray Treatment of Thymus.*†—Of the various therapeutic agencies, perhaps the most generally useful is the X-ray. And it is unfortunately human, where we have one strong card, to play that always and neglect the rest. Moreover the X-ray only succeeds when used correctly. Such work cannot hopefully be sent to indiscriminate operators. Several failures in attempts at thymic reduction have been seen from its inefficient application.

* It appears that Biedert (1896) recommended the use of Schmierseife locally in thymic trouble.

† This method of reducing the thymus appears to have been first applied in practice by Friedländer of Cincinnati (*Arch. Pediat.*, 1907). H. Heinecke (1904) worked with it experimentally, as did Rudberg (*Arch. f. Anat. and Physiol.*, 1907, p. 122). Friedländer's own results from experiments on the thymus are in accord (*Arch. Pediat.*, 1911, Oct.); he found that the X-ray causes fibrosis of the gland, yet without permanently destroying all its glandular tissue. It is claimed that this ray has a selective action on thymic or lymphoid tissue. Rachford consistently advocates it (*Am. J. Med. Sci.*, 1910, Oct.; also his "Dis. Childn.," 1912). The method is now well established here and abroad.

In one such case of this list success was subsequently achieved—which fact also further negatives any assumption of suggestion.

The X-ray is not infallible as a cure for thymic enlargement. There are other means, and often of quite as much importance for the welfare of the patient. In the long run and for the good of the greatest number, these other ways promise most. Cases in the very young, as No. 11, in a way No. 22, by necessity in No. 20, and one subvariety case on p. 306, did well without recourse to the Roentgen ray.

The application by the method of high-potential, well-filtered ray in the present cases has been carried out either by Dr. Brockway (under the kind advice of Dr. Eastmond), or by Mr. Schrop, the admirable operator at the Kings County Hospital. All that can here be attempted is a resume* of the clinical effects observed and results so far obtained.

An outline of the dulness each time is marked on the chest for guidance of the expert.

Age Effect.—According to available published reports, it is especially in infantile cases that radiation has been successful in reducing the thymus. The cases of stammerers are more difficult therapeutically, the patients are older, the glands are possibly more indurated and are certainly covered by denser bone and thicker layers of tissue. In such conditions the X-ray can not be expected to act as effectively. And it has to be used in fullest strength and longest duration.

This makes it advisable to proceed slowly. Hold-ups are to be expected. In fact no better effect is seen by too long massing of treatments. To slap right in and

* The writer has no special knowledge of X-ray work, and merely wishes to express such conclusions as seem requisite from an observation of these and other thymic cases.

give it straight ahead every three to five days, as some rule of thumb operators do, is not practicable here for much length of time.

In the older and resistant cases this must be the method of choice.

Thymic Subsidence Under X-ray Treatment.—In a few cases the disappearance of the thymus by subjection to radiation is fairly even over the whole area of dullness. In others it seems to shrink not so much in thickness as at the edge. So far, in the latter and more usual cases, it seems to contract regularly at the upper border first. After some progress has been made we get pictures like the secondary stages in the illustrations of Nos. 3, 8, 19, 23. The area of dullness at this stage is not unlike that in many partial thymics who have never exhibited the stammer.

“In X-ray therapy there is a latent period of seven to fourteen days between the time of giving the exposure and the time of the desired effects,” says Lange regarding the thymus (*Cincinnati Lanc.—Clin.*, 1911, cv, 413). This applies fairly to stammering; the improvement may progress for some time, especially after a series of treatments. The stammer does not show an immediate marked improvement, such as for instance might be expected were psychic influences the cause.

Regarding enlargements of even the far more accessible (though possibly less vulnerable) thyroid, M. K. Fisher says (*N. York M. J.*, 1915, I, 456): “In these cases in my series in which the X-ray manifested a curative or beneficial influence, the progress toward improvement as a rule followed no definite course.”

Although in many reported cases of thymic sequels of other nature great relief and cure has resulted from local use of the X-ray, it does not follow that in them the

gland has been entirely done away with. A little shrinkage, or even a reduction of its congestion, may have been sufficient. In the present cases a reduction in the area of dulness has regularly been achieved—but complete and lasting dissipation of the whole dulness has only been realized in part of the cases. It may not have been pushed sufficiently for that, through fear of possible injury.*

Frequency of Application.—As it takes a little time to influence the stammer and as there is in these cases no question of vital urgency, it is just as well to proceed carefully. A week to ten days is a fair interval between sittings.

A wise and satisfactory scheme appears to be to give it in periods. A course of two to four treatments at intervals of five to fifteen days, and then a pause of some weeks. This gives as good results as can be obtained, avoids by-effects of massing treatment, and gives a chance to be sure how much has been accomplished. And such a plan works in well with the use and proper watching of the effects of other needed agents.

A couple of applications may suffice in the lighter cases; while the severer require more or additional series. A return of dulness may call for further treatment.

* So long as the thymus passed as an indifferent or unnecessary structure the best treatment, when its size became objectionable, was naturally thought to be its removal, and the more thorough the eradication the better.

Even then careful workers felt that, at least in childhood, so considerable and evidently active an organ should be treated conservatively. Such caution becomes the more warranted as the peculiar and important functional character of the gland is better understood.

Apparently Sajous and Gudernatsch have in different ways recognized a definite thymic principle—whatever be the final form of its designation.

If Sajous is correct in the conclusion that lack of thymus induces precocious senility (*N. Y. M. J.*, 1915, I), then per contra the physical intactness of youth if not the preservation of youthfulness depends on the persistence of a degree of the thymic function. And his view is supported in a measure by the conclusion of Gudernatsch (*Am. J. Anat.*, 1914), that the thymus stimulates growth (the thyroid exciting differentiation).

It is evident that there are specific reasons for caution lest we succeed too well in our efforts at shrinking the gland.

The other accompaniments of thymism yield for the most part more slowly. Some base indications on the cytology of the blood; when lymphocytosis subsides, the radiation is discontinued.

By-Effects of the Radiation.—In a number of cases, where it has been possible to follow up the course closely, a considerable enlargement of the thymic dulness (apparently a temporary swelling of the gland), followed soon after a first use of the X-ray. This may subside but slowly; and it has not been thought well to repeat until this secondary subsidence has occurred. In one case, No. 7, the X-ray each time seemed to make the stammer worse for a period of days; then very gradually the improvement became evident.

Repeatedly the skin has reacted, short of a real burn, necessitating a wait.

In case No. 23, a hemiplegic but vigorous, an excessive degree of discomfort and prostration lasted for hours after the third and longer application.

9. *Surgical Removal of the Thymus.*—As the persistent thymus has no useful purpose its operative removal may be considered.

The method of operation by extracting the thymus via the suprasternal notch may or may not be as applicable in these cases as in those of infancy, since the gland rarely extends quite up to the rim of the chest. The impressive character and inevitable dangers attending the older method by temporary exsection of the manubrium must ordinarily forbid it.

In the present connection thymectomy can well be kept in reserve for selected or obstinate cases.

10. *Diet.*—As these children are often great eaters, stowing away a vast amount of food and at all times when accessible, there is a prospect that much can be

accomplished therapeutically by limiting and regulating their diet. The matter, however, has not been sufficiently tried out to determine how well they stand a shortening of fare or whether it should be along particular lines. In case No. 20 a general limitation of the food supply has proven very advantageous.

Soderlund and Backmann (1909) produced a reduction of the thymus to one-tenth of its weight by several days of starvation. And somewhat similar results experimentally were gained by Johnson. This serves to strengthen the clinical indication; though such cases rarely seem in condition to tolerate any severe regime. We can safely and advantageously begin with a little stinting, and then decide whether or not to be more strenuous in this regard.

After-Care.—The successes of these methods are easily understood on the present basis. But, no matter how well we succeed in “pinching” the thymus and in curing the stammer, there will still remain in many cases the hypotony, bad habitus, bone changes, and allied relics. The after-treatment of these will give ample scope for all the available agencies. Improvement of muscular tone will be a most important aim.

Those of the above methods which yield quickest relief of the stammer are of least use in this later care, and vice versa.

Mention might also be made of a plan that has some possibility of future usefulness. This is the application of the Abderhalden method, or the use of normal or other serum. As yet its value here does not appear to be demonstrated.

SUMMARY OF CONCLUSIONS.

1. Stammering is not primarily a disorder of the central nervous system. Nor is it an isolated, freak or just functional affair, but is always at the start a symptom and part of a widespread or systemic condition.

2. This general condition is a phase of hyperthymism, closely allied to or part of that known as lymphatism. The clinical coincidence herewith of the facts regarding stammerers is both proof and control of the correctness of the explanation offered.

3. There is regularly some block in the thymic area, usually attributable to thymic enlargement or persistence.

4. The morbid influence thus exerted and constituting the immediate cause of the stammer may provisionally be classed as an inhibitory reflex, systemic or other influences acting as accessories.

5. Circulatory troubles, present in at least half the cases, play a considerable though auxiliary role. Likewise any interference with free naso-pharyngeal respiration, coryza, laryngitis, etc.

6. Developmental bone defects, largely of rachitic type, are common in stammerers. Some degree of muscular hypotony is the rule in youthful sufferers, involving especially the trunk muscles. Excessive eating is a feature in nearly all cases. The cases presented indicate also a moderate overgrowth in height.

7. Enlargement of the thyroid is more common in girls, while that of thymus is more common in boys.

8. The relative immunity of females to stammering is due to, *a*, the lesser frequency of thymo-lymphatism in girls, *b*, the costal type of respiration in females.

9. The heredity in these cases does not apply to the stammer directly but to the tendency to thymic hyperplasia or the recurrence of developmental error.

10. This disorder and the state of which it forms a part require internal or systemic, general hygienic, and also local treatment. In uncomplicated cases it yields as promptly and fully to suitable care as does the average run of chronic disorders. In addition the therapeutic test serves, if possible, more positively to demonstrate the correctness of the facts and deductions.

Perhaps more important than all these conclusions is the general proof that thymic conditions and disorders are as amenable to study as are those of other organs of the body.

ACKNOWLEDGEMENTS.

A work of this character and touching so many lines cannot be carried out by a private individual without the incurring of many obligations. Some, including the special services of Dr. Beers and of Dr. Brockway, have been mentioned. To others, as Professor Alfred E. Ives, Principal of P. S. 35, our all-wise medical librarian Mr. Huntington, Dr. J. M. Winfield, Dr. W. C. Woolsey, the excellent internes at the Kings County Hospital, and other colleagues who have aided in various ways, the writer begs to extend his deepest appreciation.

EDITORIAL NOTE.

Completion of the first volume of *Neurographs* offers the chance for a fuller statement regarding the journal.

The scientific character, ideal purpose, and mechanical superiority of the publication is apparent to anyone who takes note of such matters. The attainment of these, in the best American manner, was one of the primary objects of the undertaking; it seemed, however, better to defer saying much about them until a successful demonstration had been made.

Papers have been limited to those of professional interest and of scientific character in the practical rather than pedantic sense, every one representing some order of original research.

The satisfactory issuance of original scientific material and its prompt and correct presentation are matters of increasing moment. The great weeklies and monthlies stock up with contributions months ahead, and in addition much of it has to be announced still further in advance on some society's program; that an occasional author engages a place in advance does not materially modify the fact and certainly is no comfort to the great majority who are handed the left-over places, no matter how good their work.

The exclusion of medical cold hash, fillers, pot-boilers, discussions, and secretarial space-absorbers should be appreciated by judicious as well as weary readers.

Neurographs is distributed, as probably no other publication in this country at least, to all centers of medical progress and activity the world over. Partly because it thus secures a hearing, recognition of *Neurographs*, its offerings and contributors, has been peculiarly gratifying.

On both the ethical and mechanical sides is to be credited the freedom from extraneous matter, especially from all and every species of advertising; such paid matter tends to distract the reader, bias the management, and interfere with the quality and standing of any scientific journal. The ogre of controlled medical journalism, as by society or private interest, can best be thus met; and the still more ominous control of all agencies by a few endowed and self-satisfied institutions entirely out of touch with real life and practice can hardly be countered in any other way.

Typographical and mechanical excellence have been striven for; of size and form for greatest convenience of perusal; adapted to carry illustrations of some extent and yet the whole to go flat in the coat pocket; so bound as to open as freely as the choicest of old work and to be held easily in the hand; with paper of a favorable tint for over-used eyes, and of a quality to take prints, yet not so heavily calendered as to be burdensome in the hand.

Such have been some of the objects—to make a type publication. While somewhat comparable enterprises find place abroad, there appears to be no counterpart in this country. Individuals here are well able to adopt such a course; it simply requires a perception of our needs.

The policy of issuing numbers as material demands rather than at fixed dates will be continued.

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